USER GUIDE

FM-1000™ Application

Version 9.25

Revision A

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CHAPTER 1

Introduction

In this chapter:

About the FM-1000 integrated display **22**

Changes to this document **24**

This user guide includes information on setting up and using the FM-1000™ integrated display. For installation information, see *FM-1000 Integrated Display Cabling Guide*.

About the FM-1000 integrated display

With the FM-1000™ integrated display, you can perform:

- Field definition and mapping
- Feature mapping
- Guidance to predefined field patterns
- Logging of coverage data
- Variable rate control
- Boom/Row switching
- Logging of topographic mapping data
- Output of information for analysis in office-based Geographic Information System (GIS) software
- Seed, Liquid, Granular, and Anhydrous Ammonia control
- Seed monitoring

Optional features

The FM-1000 integrated display has a number of optional features /plugins you can install to expand its functionality.

Most of these features require additional hardware. For installation information, see the *FM-1000 Integrated Display Cabling Guide*.

Note *– Some configuration settings are unavailable when a field is open in the Run screen. To access these settings, return to the Run screen and then tap the Home button. When prompted to close the field, tap* ***Yes****.*

Also see Optional features/plugins (page 37), Unlock features / plugins (page 43) and Activate features/plugins for use (page 45).

Compatibility

The following are compatible with the FM-1000 integrated display:

- Trimble Autopilot™ automated steering system
- Trimble EZ-Steer® assisted steering system
- Trimble EZ-Pilot® steering system
- Trimble TrueTracker™ implement steering system
- Trimble TrueGuide™ implement guidance system
- Trimble FieldLevel™ II

- Trimble WM-Drain® farm drainage system
- Trimble Rawson™ drive
- Trimble Field-IQ™ crop input control system
- Trimble RangePoint™ RTX™
- Trimble CenterPoint™ RTX and CenterPoint VRS™
- Trimble VRSNow™
- Trimble Farm Works Software®
- Trimble GreenSeeker®
- Trimble Tru Count Air Clutch®
- Trimble AutoSense™
- Trimble T2™ terrain compensation technology
- Trimble T3™ roll compensation
- OmniSTAR® wide-area differential GPS service
- Trimble NextSwath™ end of row turn technology

Installation

To install the display and required cabling for your configuration, see the *FM-1000 Integrated Display Cabling Guide*.

Changes to this document

The changes for this document for the FM-1000 integrated display version 9.25, revision A are:

- Remote Output: Crossing a Line Feature has been added. See Remote Output settings (page 118) and Remote Output operation (page 375).
- WM Drain: Changes to the *Run* screen and added features, including clipping/deleting a section line and adding fixed points during design. See WM-Drain operation (page 410).
- Serial NMEA messages: 10 Hz has been added as an output. See Serial NMEA messages (page 115).

CHAPTER 2

Display basics

In this chapter:

Display power on/off **26**

Main screens **27**

Passwords **36**

Optional features/plugins **37**

Screen shots **39**

The FM-1000 integrated display has five main screens you use for setup and operations. You can also access on-screen help.

Optional features (plugins) are available to add to the display.

Display power on/off

Note *– The display must be correctly installed* ***before*** *powering on. For more information, see FM-1000 Integrated Display Cabling Guide.*

Power on

Briefly hold down the power button (for approximately half a second). The display turns on, and after a pause the Home screen displays.

Power off

1. Close all fields before you power off the system. See Close a field (page 321).

   Note *– If you fail to close before rebooting or shutdown, you may experience a loss of data.*

2. Either return to the Home screen and tap **Shutdown**, or turn off the display manually by holding the power button down for about two seconds.

   Note *– Sometimes after you press the power button and tap* ***Shutdown****, the display does not immediately turnoff. This is because the FM-1000 integrated display is saving settings. The display will power off after all settings are saved.*

Main screens

The FM-1000 integrated display has the following main screens:

- Home screen (page 28): The first screen that displays when you open
- Run screen (page 34): For performing operations
- Configuration Selection screen (page 29): For switching and editing selections for system, vehicle and implement
- Configuration screen (page 33) (and subsequent setup screens): For setting up the system and features
- Field Selection screen (page 32): For choosing which field to work in

Home screen

The *Home* screen lists the following information about the configuration:

- The display build date, firmware and hardware version
- All optional features/plugins loaded on the application
- The automatic steering system (if applicable)
- The GPS receiver version, correction source and subscription information
- The selected vehicle make and model

The *Home* screen has three tabs:

- Support tab, containing the buttons:
  - **Data Files**: Tap to display the *Data Files* screen where you can transfer files between the display and a USB drive. See Managing data (page 78).
  - **Upgrade**: Tap to display the *Firmware Upgrade* screen, where you can upgrade firmware. See Upgrade FM-1000 integrated display firmware (page 44).
  - **Unlocks**: Tap to display the Advanced Functionality Access screen and unlock enhanced features / plugins. See Unlock features / plugins (page 43).
- System Information tab, listing about the configuration:
  - Display firmware build date, firmware, and hardware version
  - Optional features/plugins loaded on the application
  - Vehicle and implement automatic steering controller version, date, and serial number (if applicable)
  - GPS receiver version, correction source, and subscription information
  - Selected vehicle make and model
- Camera, tab:

Configuration Selection screen

Before you enter the *Run* screen, the *Configuration Selection* screen shows the current configuration selected for the:

- System
- Vehicle
- Implement

Access the *Configuration Selection* screen from the *Home* screen.

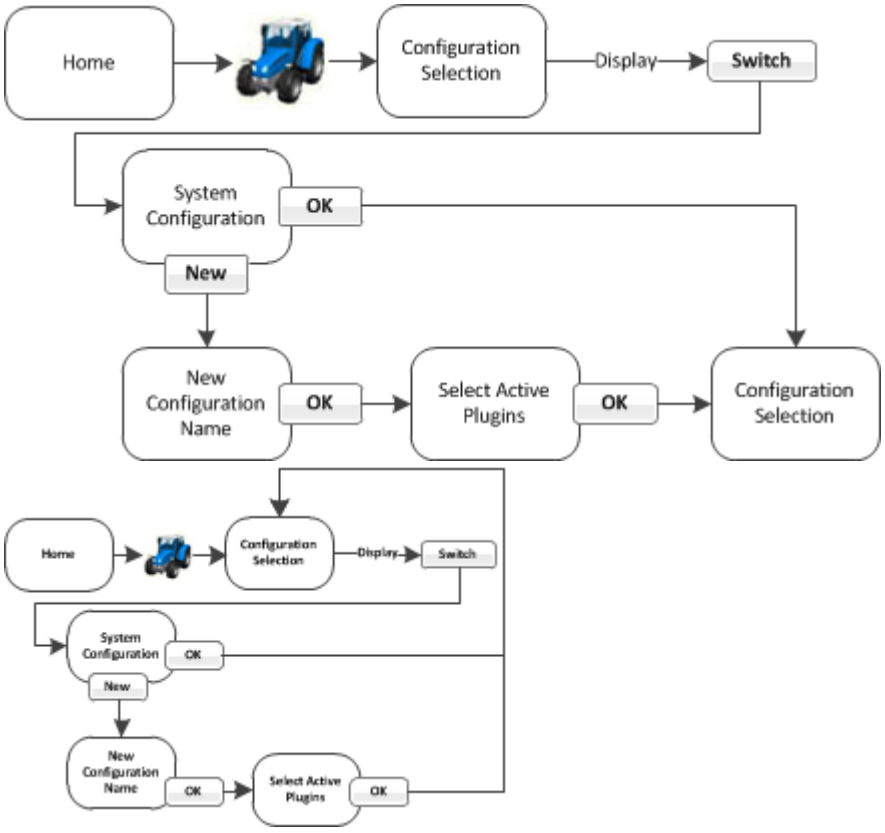
For each of these you can:

- Switch to another system, vehicle or implement
- Edit settings

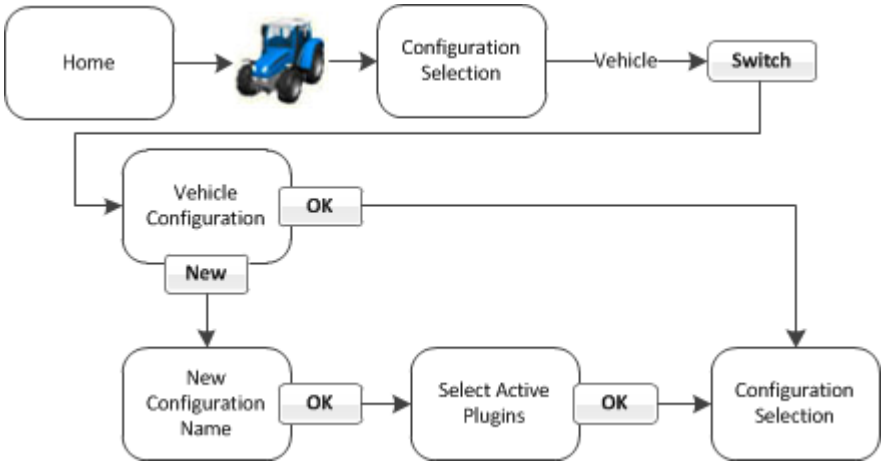
The *Configuration Selection* screen shows the current configuration selected for the:

- System
- Vehicle
- Implement

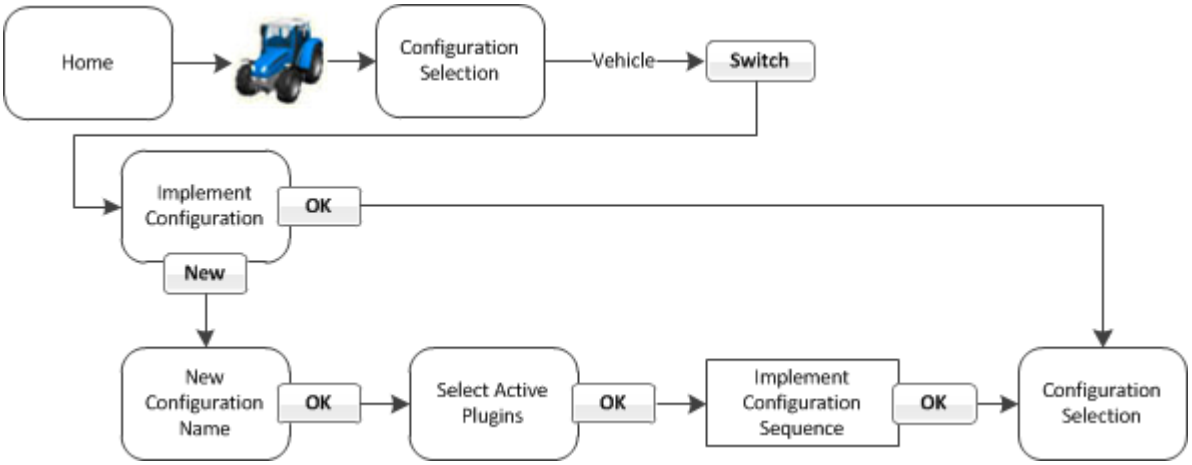
System configuration switching



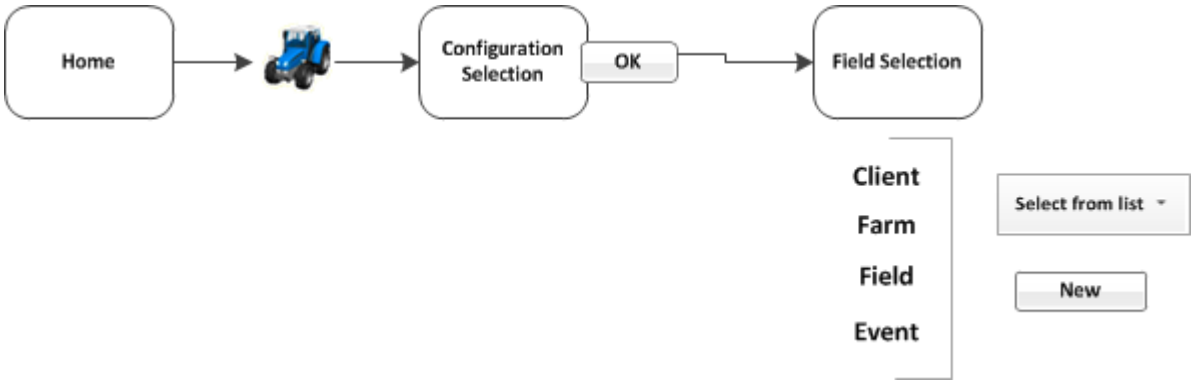
Vehicle configuration switching



Implement configuration switching



Field Selection screen

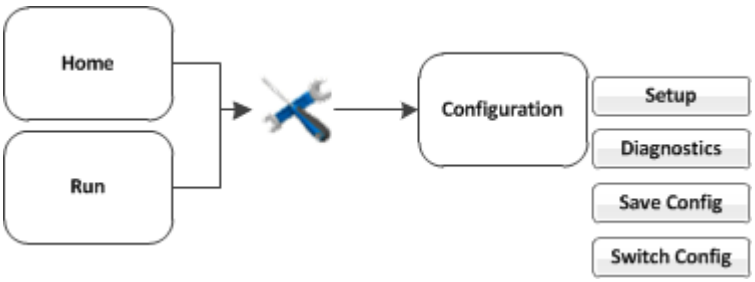


1. When you want to go to a field to begin work in the *Run* screen, tap at the *Home* screen.
2. If the system, vehicle and implement at the *Configuration Screen* are what you want to use, tap **OK**.
3. At the *Field Selection* screen, you can:
   - Choose existing fields you have created in the system
   - Create a new field (as well as the client, farm and event associated with it)

For more information, see Field creation / selection (page 319).

Configuration screen

You can access the *Configuration* screen from the *Home* or *Run* screen.



Note *– Some configuration settings are unavailable when a field is open in the Run screen. To access these settings, return to the Run screen and then tap . When prompted to close the field, tap* **Close***. Then tap* *to access the Configuration screen.*

For each item shown in the configuration list on the *Configuration* screen, you can:

- Change settings
- View diagnostics
- Save the configuration
- Switch the selected configuration

You can also add or remove features/plugins to perform different operations. See Activate features/plugins for use (page 45).

Run screen

You access the *Run* screen from the *Home* screen.

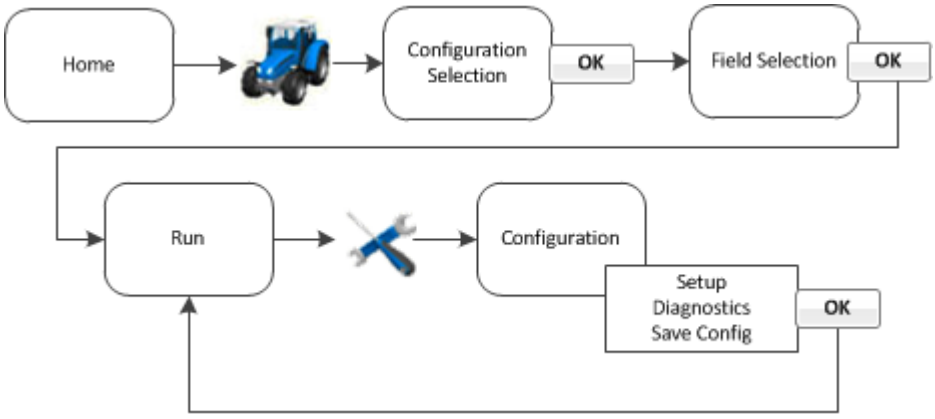
You can also move between the *Run* screen and the *Configuration* screen in some cases.

The *Run* screen is used during operations and shows your guidance lines and an on-screen representation of your vehicle in the field. The areas of the *Run* screen include:

- Operational view (page 314)
- Main buttons (page 311)
- On-screen lightbar for vehicle (page 318)
- Optional features/plugins (page 37)
- Coverage button and information (see Coverage button for logging (page 318))
- Engage button (page 317) , if applicable

You can navigate from the *Run* screen to the *Configuration* screen to:

- Change settings
- View diagnostics
- Save configuration (in some cases)



Help screen

The FM-1000 integrated display has on-screen help that provide details and helpful information about the current screen.

1. To access help, tap . A *Help* screen displays.
2. To exit the *Help* screen and return to the previous screen, tap **OK**.

Passwords

The access and administration passwords apply to the FM-1000 integrated display.

Access password

Any **Setup** or **Calibrate** button marked with a padlock icon is protected by two passwords:

- Administration password: Your password.
- Master password: A backup password in case you lose the Administration password. If you need the Master password, contact your local reseller.

The password screen displays the first time that you tap a **Setup** or **Calibrate** button after you turn on the FM-1000 integrated display. Use the on-screen keyboard to enter the administration password and then tap **OK**.

Note *– Passwords are case sensitive.*

Change administration password

Note *– To change the Administration password, you need the Master password. If you do not know it, contact your local reseller.*

1. If you have not entered the password during the current session, at the *Configuration* screen tap **Setup** or **Calibrate** .
2. If you have already entered the password during this session, tap button and then tap **Lock Configuration**. On the *Configuration* screen tap **Setup** or **Calibrate**.
3. The *Enter Administration Password* screen displays.
4. Enter an incorrect password. The *Wrong Password* screen displays.
5. Tap **Enter Master Password**.
6. Enter the master password and then tap **OK**. The *Change Administration Password* screen displays.
7. Enter your new administration password in both fields. The new administration password is now active.

Optional features/plugins

The FM-1000 integrated display has a number of optional features (plugins) you can install to expand its functionality. Most of these features require additional hardware. You must:

1. Purchase the feature.
2. Install any hardware required by the feature.
3. Unlock the feature. See Unlock features / plugins (page 43).
4. Activate the feature for use. See Activate features/plugins for use (page 45).
5. Configure the feature.

Vehicle guidance

- Trimble Autopilot™ automated steering system: See Autopilot system (page 146).
- Trimble EZ-Pilot™ assisted steering system: See EZ-Pilot assisted steering system (page 166).
- Trimble EZ-Steer® assisted steering system: See EZ-Steer assisted steering system (page 172).
- RG-100 Row Guidance system: Works with the Autopilot system to center the combine on the rows. See Row Guidance (page 163).

Features for application

- Trimble Field-IQ™ crop input control system: Control sections and vary application rates. See Field-IQ system setup (page 184) and Field-IQ operation (page 347).
- GreenSeeker®: Vary fertilizer rate in real-time using crop vigor measurements. See GreenSeeker functionality (page 216) and GreenSeeker operation (page 368).
- Serial Rate Controller: Use a variable rate controller. See Additional controller setup (page 235).

ISOBUS

- Virtual Terminal: View and use Virtual Terminal. See Virtual Terminal setup (page 222) and Virtual Terminal operation (page 374).
- Task Controller: Use Task Controller. See Task Controller setup (page 222) and Task Controller operation (page 373).

Implement control

- Trimble TrueGuide™ implement guidance system: Use guidance on the implement for greater accuracy. See TrueGuide system (page 238) and TrueGuide operation (page 386).
- Trimble TrueTracker™ implement steering system: Automatically steer the implement for greater accuracy. See TrueTracker (page 244) and TrueTracker operation (page 383).

Connectivity

- Ag3000 modem: Receive cellular RTK corrections. See Ag3000 modem (page 124).
- DCM-300 modem: Receive RTK corrections from a VRS™ network, a third-party RTK provider or a CORS. See DCM-300 Modem (page 125).
- Vehicle Sync: Transmit data between vehicles. See Vehicle Sync (page 260).
- Serial Data Input: Enable data input from an external serial device. See Serial Data Input (page 124).
- Remote Output: Enable remote data output to an external device. See Remote Output setup (page 118).
- EZ-Remote™ Joystick: Control a variety of display functions remotely. See EZ-Remote Joystick (page 50).

Water Management

- Survey and design: Survey a field and then create a design. See Survey the field (page 393) and Create / save a design (page 395).
- FieldLevel™ II:
  - Level the field to a design, install subsurface drainage or surface ditches. See FieldLevel II Leveling (page 268).
  - Control leveling with two GPS receivers, in one of two possible scraper configurations. See Tandem / dual scraper setup (page 275), Dual scraper controls (page 408), and Tandem scraper controls (page 409).
- WM-Drain® farm drainage solution: For subsurface drainage. See WM-Drain setup (page 278) and WM-Drain operation (page 410).

Harvest

- Yield Monitoring: Display yield monitoring data. See Yield Monitoring settings (page 294) and Yield Monitoring operation (page 428).

Screen shots

To save an image in the *Run* screen, tap .

The image is stored in the folder: AgGPS\Diagnostics\Screenshots.

- In the Data Dictionary under Diagnostics \ Screenshots

CHAPTER 3

Basic settings

In this chapter:

Unlocks and upgrades **42**

Activate features/plugins for use **45**

Basic system settings **46**

Basic settings include:

- Upgrades: Upgrading the system firmware or features you have purchased and activated
- Unlocks: Features you purchase are included with a passcode so that you can unlock them on your system.
- Activation for use: After you have unlocked a feature, you can activate it for use for your operation. You can also deactivate features in order to activate other features for use.

Unlocks and upgrades

Unlocks are passcodes you enter to activate a feature or service on the display after you have purchase it.

Upgrades are firmware updates to the existing firmware or feature that you have already activated.

Unlock features / plugins

To unlock / activate some plugins, you must enter the activation password (or unlock). If you do not have an activation password, contact your local reseller. You can activate a plugin using:

- A text file
- The display

Unlock a plugin using a text file

Note *– This method of unlocking a plugin is faster than the manual method.*

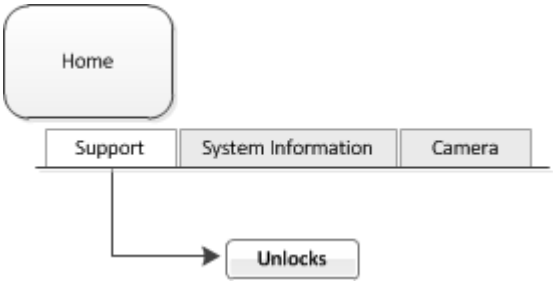
1. Insert the USB drive from the FM-1000 integrated display into a computer.
2. Rename the text file.
3. Delete the label of the name following the password number. For example:

   Password 4850576341 FMX 2DGPSto2GLONASS.TXT

   becomes

   Password 4850576341.TXT
4. Copy the password text file from the computer into the \AgGPS\Firmware\ folder on the USB drive.
5. Insert the USB drive in the display and turn on the display. The feature/plugin is automatically unlocked.

Unlock feature/plugin manually



1. Turn on the display.
2. At the *Home* screen on the Support tab, tap **Unlocks**. The *Advanced Functionality Access* screen displays.
3. Select the feature/plugin and then tap **Unlock**. The on-screen keyboard displays.
4. Enter the password that your local reseller provided and then tap **OK**. If you entered:
   a. A correct password, an Enabled message displays. The plugin is now unlocked.
   b. An invalid password, an error message displays. Enter the password again. If it still does not work, contact your local reseller.

Upgrade FM-1000 integrated display firmware

1. Transfer the new firmware file from www.trimble.com to your computer.
2. Connect a USB drive to your computer.
3. Unzip the firmware file. Save it to the root folder of the USB drive.
4. Insert the USB drive into the USB socket on the rear of the FM-1000 integrated display.
5. Press the power button on the rear of the display to turn on the display and then wait for the *Home* screen to appear.
6. Tap **Upgrade**. The *Firmware Upgrade* screen displays.
7. Select a firmware file from the Firmware list and tap **Upgrade**.
8. After the upgrade is complete, tap **OK**. The system restarts.

Activate features/plugins for use

All features that have been unlocked must be activated (or "added") for use before you can set up or use them.

1. Open the FM-1000 integrated display if you are not already in it.
2. At the *Home* screen, tap .

   Note *– To add or remove features/plugins, you must access the Configuration screen only from the Home screen.*
3. At the *Configuration* screen, tap **Add/Remove**. The *Select Active Plugins* screen displays.
4. To use a feature, select it from the Inactive Plugins list and tap **Add >**.
5. To stop using a feature, select it from the Active Plugins list and tap **<Remove**.
6. When you are finished with your choices, tap **OK**. The system returns you to the *Configuration* screen.

Basic system settings

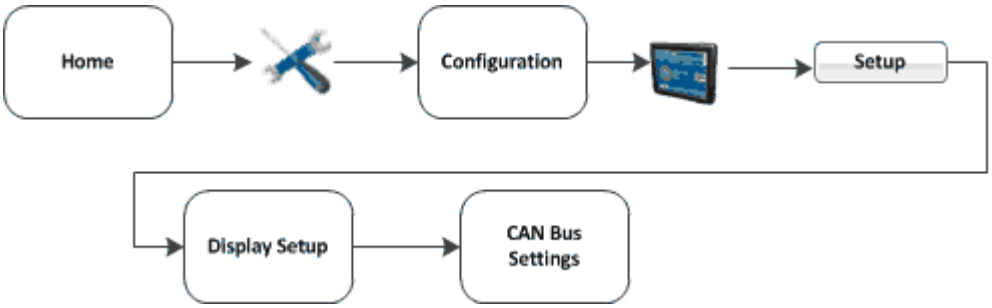
At the *Configuration* screen, select the System option and then tap **Setup**. The *Display Setup* screen displays.

If required, enter the administrator password. See Passwords (page 36).

1. At the *Configuration* screen, tap System in the list, then tap **Setup**.
2. If necessary, enter the administrator password. See Passwords (page 36).
3. The *Display Setup* screen displays.
4. At this screen, you can navigate to and edit:
   - CAN bus settings (page 47)
   - Data dictionary (page 48)
   - EZ-Remote Joystick (page 50)
   - Field feature mapping settings (page 51)
   - Guidance settings (page 52)
   - Language, measurements, keyboard layout (page 53)
   - Lightbar settings (page 58)
   - Map settings (page 54)
   - Power management (page 60)
   - Signal input module for OEM switch (page 62)
   - Sounds (page 63)
   - Status items (page 64) that display on the *Run* screen
   - Time setup (page 76)

   You can also return the display to its default settings. See Restore default settings (page 61).

CAN bus settings

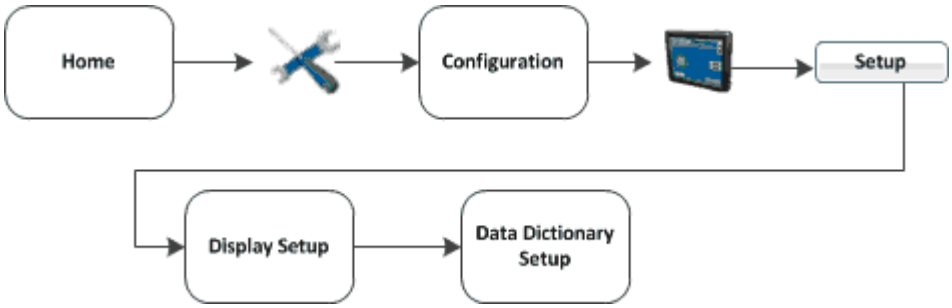


Note *– These settings are very advanced. Use them only under the direct advice of Technical Support.*

At the *CAN Bus Settings* screen, complete the settings and tap **OK**.

Setting	Explanation
CAN A Termination CAN B Termination	If the either CAN buses do not have a physical terminator, enable the CAN Termination option for that bus. • Early hardware revisions of the FM-1000 integrated display will terminate ports A and B. • Later revisions will terminate B or D.
CAN Driver Strength	Enable this setting to control the strength of the edges on the CAN bus. ***Note*** *– It is recommended that you set the CAN driver Strength to Full.*

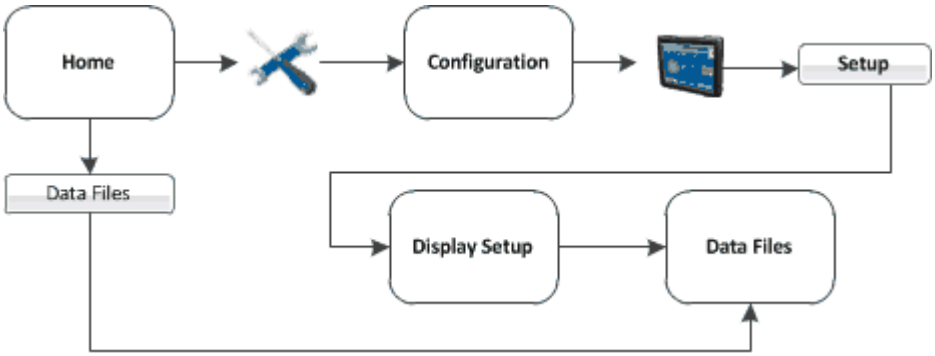
Data dictionary



For information about data management, see:

- Managing data (page 78)
- Data Dictionary categories (page 94)
- Create / load a data dictionary (page 95)

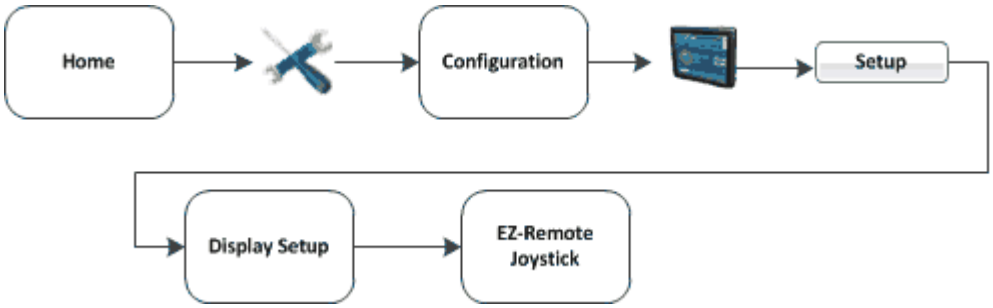
Data Files



At the *Data Files* screen, you can transfer data. See Transfer data (page 78).

You can access the *Data Files* screen from the *Display Setup* screen as well as from the *Home* screen.

EZ-Remote Joystick



For installation information, see the *EZ-Remote Joystick Quick Reference Card*.

If you use the EZ-Remote joystick, you do not need to tap buttons on the display. This improves your accuracy when you select buttons, and gives you faster reaction times. You can program the EZ-Remote joystick to controls the functions of the FM-1000 integrated display.

Note *– The functions available to assign to each button depend on which optional features (plugins) are activated on the display.*

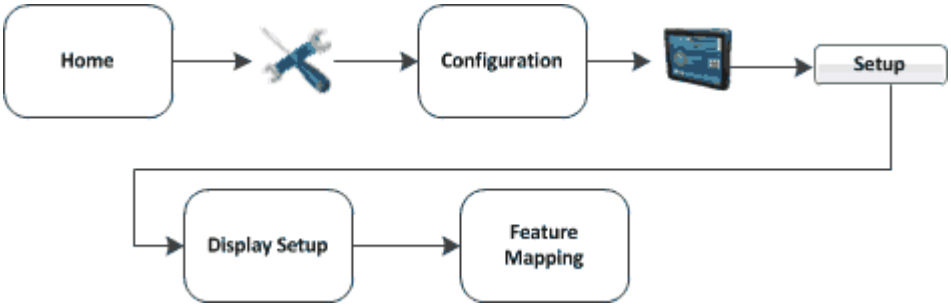
1. Connect the EZ-Remote joystick into into Port B on the back of the display. An EZ-Remote joystick icon automatically displays on the *Configuration* screen.
2. At the *Configuration* screen, select *EZ-Remote* and then tap **Setup**. The *EZ-Remote Assignment* screen displays.

   Configure each key for the function you want to control remotely. You can also adjust the brightness of the LED joystick buttons.
3. On the EZ-Remote joystick, press the first button you wish to program. The *Function Assignment* screen displays.
4. Tap the feature that you want to program into that button on the control joystick.
5. Tap **Set** and then tap **OK**. The *Keypad Assignment* screen displays again.
6. Repeat steps 2 through 5 to program more buttons as required.
7. When completed, tap **OK**.

Note *– You can configure the EZ-Remote control joystick while operating in a field. From the Run screen, tap* *and then follow the previous steps.*

Field feature mapping settings

A field feature is an item you designate on the display while your in your field to indicate lines (such as fences), areas (such as areas to exclude) and points (such as rocks).



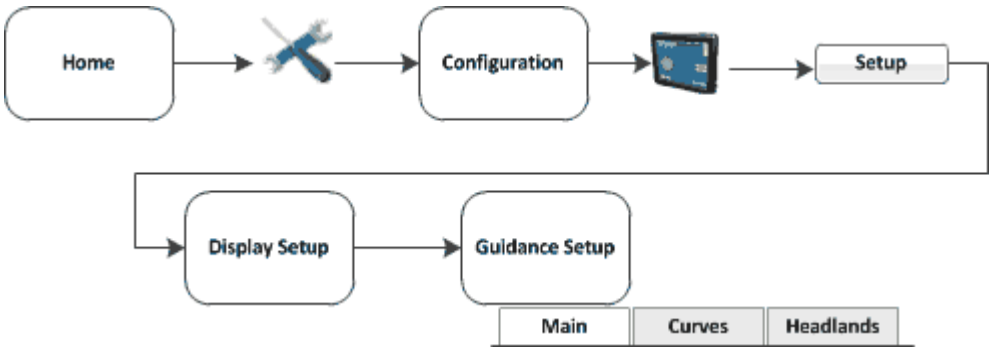
The field feature mapping settings determine:

- What buttons are available on the Mapping Guidance panel of the *Run* screen for creating features in the field
- The reference point for creating field features (center, left or right of the boom)
- If a path should be recorded when you begin logging coverage
- The types of warnings that can trigger when entering a feature or area
- When to restrict remote output
- How a boundary is recorded

For detailed information, see Field feature mapping settings (page 130).

Guidance settings

Note *– If you are setting up the system for the first time, you should not need to adjust these settings.*

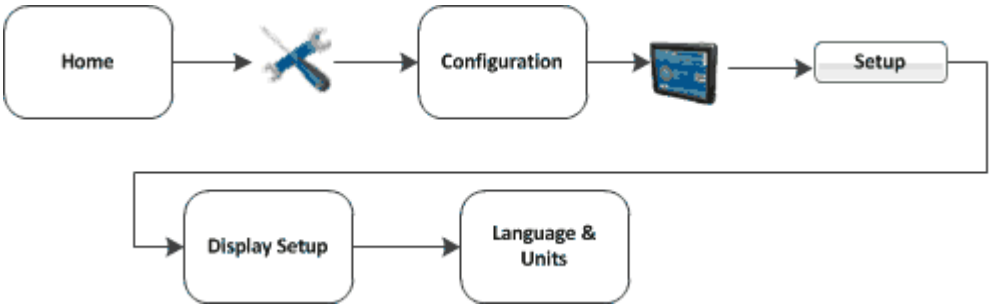


Setting	Explanation

Limit Field Selection	Limits the number of fields that display when you are selecting a field.
	• Yes: Enables Limit Field Selection. The displayed fields are within the set radius of the vehicle's current location, based on the vehicle's GPS position.
	• No: Disables Limit Field Selection
	• Selection Radius: Fields that fall within this radius will display. To exclude:
	  • More fields, enter a smaller number
	  • Fewer fields, enter a larger number

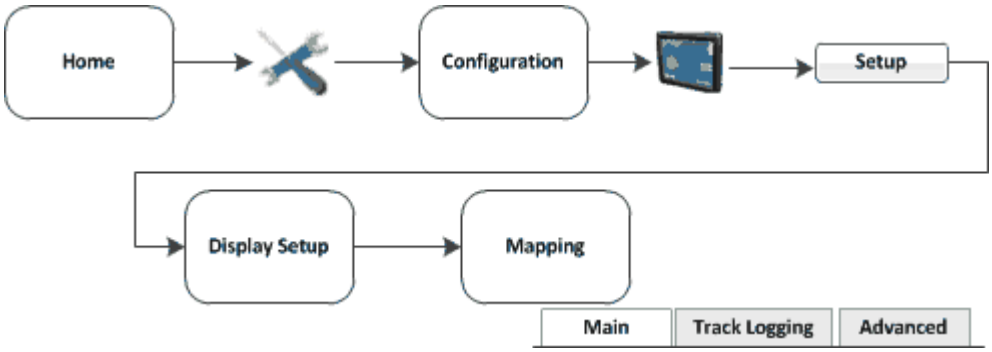
Auto Steering Lockout	Disables engagement of an automated guidance system until you enable guidance in the *Run* screen. • Yes: System functions as normal. Auto Guidance Enabled on/off is still allowed. • No: System cannot engage. The Engage button shows as red.

Language, measurements, keyboard layout



Setting	Explanation
Language	Can be changed if you have chosen FM-1000 Only for the Language Selection. If you change the language, a message warns that the display will turn off so that the change can take effect.
Display Units	Select the unit of measure for the display: • Metric • Feet and Inches (default) • Decimal Feet
Keyboard Layout	The FM-1000 integrated display uses an on-screen keyboard on the touchscreen. Options for layout: • ABCDEF: Letters appear in alphabetical order • QWERTY: Layout the same as a computer keyboard (default)

Map settings

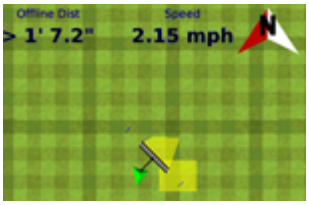
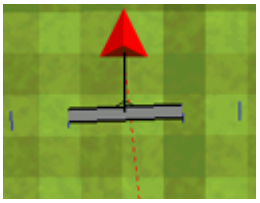


At the *Mapping* screen, you can complete settings on these tabs:

- Main
- Track Logging

Main tab

Note *– For a new toolbar orientation to take effect, restart the display.*

Setting	Explanation
Map orientation	Controls the direction that the screen follows the position of the vehicle. • North Up: When you perform a turn, the field remains stationary and the vehicle turns.  • Vehicle Up: When you perform a turn, the field rotates but the vehicle remains pointing up.  ***Note*** *– To change the map orientation from the Run screen, tap the north arrow.*
Color scheme	• Default mode: For use during the day • Night-mode: For use at night The night-mode color theme uses darker color themes to cause less eye strain in low light conditions.
Save summaries	• On: The display creates a saved file for your work. • Off: The display does not create a saved file for your work.

Track Logging tab

On the Track Logging tab, you can configure the display to record the vehicle track at either a set time or a set distance. Points along the trck are logged at the greater of the two values (either logging time or logging distance).

To always log a point based on either of the two values, set the other value to zero. To disable track logging, set both values to zero.

Setting	Track logging is...
Distance = 0, Time = 0	Turned off
Distance = 1+, Time = 0	Recorded by distance (m)

Setting	Track logging is...
Distance = 0, Time = >1+	Recorded by time (s)
Distance = >1+, Time = >1+	Recorded by whichever setting is higher

Track logging files

Track logging files are created whenever you open an event. The track file records points at the rate set on the Track Logging tab. At each point, a number of attributes are recorded.

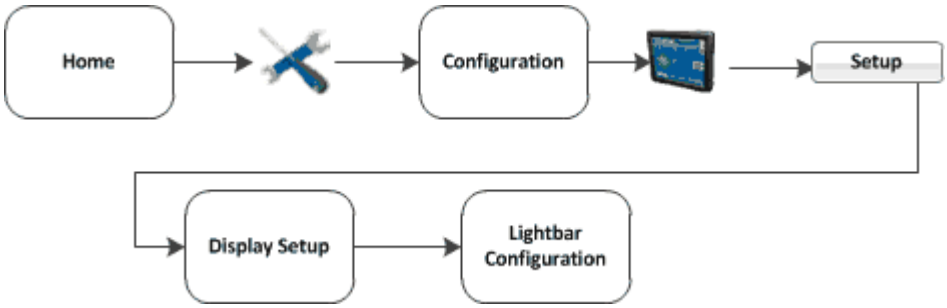
Note *– The data stored in the track logging file (Track3D_<date time>.dbf) is in metric units.*

The information stored for each point in the track logging file is listed in the following table.

Column	Description	Units
Along_Line	Along line distance from start of swath. Attribute Not Populated	meters
Ant_HAE	Antenna height above ellipsoid. Attribute Not Populated.	meters
Ant_Lat	Antenna latitude (WGS-84).	DD.dddddddd
Ant_Long	Antenna longitude (WGS-84).	DD.dddddddd
Appln_Wdth	Application width.	meters
As_Applied	Applied rate. Attribute Not Populated	–
Auto_Steer	Auto-Steer flag (1=on, 0=off).	On or off
Corct_Age	DGPS signal correction age.	seconds
Field_Name	The name of the field.	–
GPS_Status	GPS status value (NMEA).	1, 2, 5, 4
Ground_HAE	Ground height above ellipsoid. Attribute Not Populated	meters
HDOP	Horizontal Dilution of Precision – A measure of the quality of positions based on satellite geometry.	–
Heading	Direction of travel with respect to true North.	decimal degrees
Height	Mean sea level height of ground.	meters
Local_Time	Local time.	hh:mm:ss.s

Column	Description	Units
Logging_On	Coverage logging flag (1=on, 0=off).	On or off
Num_Stats	Number of GPS satellites.	–
Offline	Offline distance from swath center line.	meters
Pitch	The pitch. Attribute Not Populated	–
Relative_Height	Height.	meters
Roll	The roll. Attribute Not Populated	–
Speed	GPS-derived ground speed.	kph
Status_Text	GPS status description.	–
Swath_Num	Current swath/headland number.	
Swath_Wdth	Swath width.	meters
Target	The target rate at the current position.	–
Total_Qty	Total volume of material as applied for the current field. Only supported for the Aerial Flow Controller, Autocal Flow controller, and Crophawk Flow Meter.	–
Units	Units. Attribute Not Populated	metric
UTC_Date	Point creation date.	YYYYMMDD
UTC_Time	UTC time.	hh:mm:ss.s
Version	Track attribute file version.	–
Yaw	The yaw. Attribute Not Populated	–

Lightbar settings



The display has two lightbar options:

- The on-screen lightbar that displays at the top of the *Run* screen
- One or more external lightbars

On-screen lightbar

You can edit the default settings for the on-screen (virtual) lightbar.

1. At the *Display Setup* screen, select Lightbar.
2. Tap **Setup**. The *Lightbar Configuration* screen displays.
3. Tap Virtual Lightbar and tap **Setup**.
4. Complete the settings as appropriate.

Setting	Explanation
LED spacing	The distance represented by each LED on the lightbar. a. Tap the appropriate number field. b. Enter the required values. Default: 3 cm per LED/1" per LED
Display Mode	How the LEDs respond to offline distances. When “Show error” is selected, the display shows the direction that you need to move in. When Show correction is selected, the display shows your current distance offline. a. From the list, tap the appropriate option. b. Enter the virtual lightbar settings, then tap **OK**. c. At the *Lightbars Configuration* screen, tap **OK**. Default: show error (chase mode)

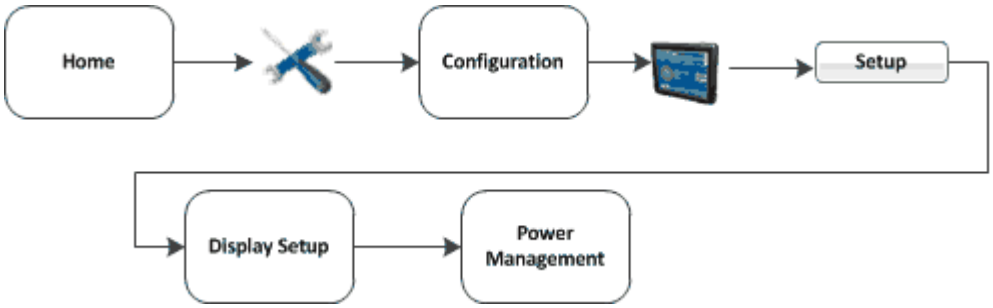
External lightbar

To set up the external lightbar:

1. Connect the LB25 lightbar to port B on the back of the FM-1000 integrated display.
2. At the *Display Setup* screen, tap Lightbar.
3. Tap **Setup**. The *Lightbar Configuration* screen displays.
4. Tap Lightbar and tap **Setup**.
5. Complete the settings as appropriate.

Setting	Explanation
Name	Name and serial number of the lightbar
Orientation	Choose the orientation of the lightbar
Brightness	Setting for how bright the lightbar displays
LED Spacing	The distance represented by each LED on the lightbar. a. Tap the appropriate number field. b. Enter the required values. Default: 3 cm per LED/1" per LED
Lightbar Purpose	Choose the purpose of the lightbar
Look ahead time	The distance ahead of the vehicle that the lightbar will use for LED guidance and offline distance. Default: 0 seconds

Power management



To manage power, you can set the display to dim the backlight or turn off the display after a pre-set period of inactivity.

Setting	Explanation
Turn Off Backlight	Length of time before the backlight turns off.
Turn Off System	Length of time before system turns off.

Restore default settings

You can reset the FM-1000 integrated display to its default values. This can be useful if:

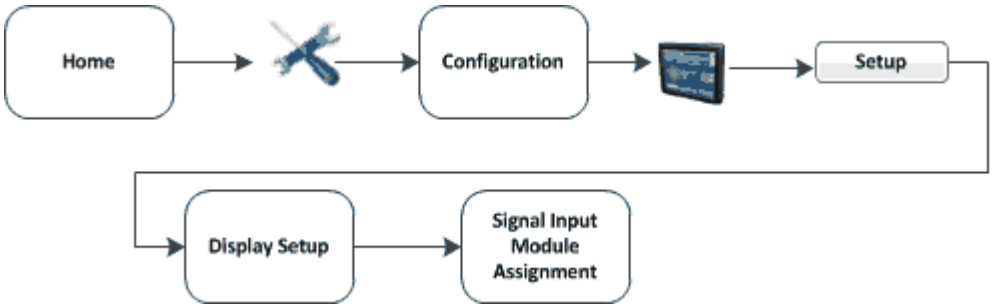
- You made changes to the display settings. The results are poor, but you cannot determine which setting was the cause.
- You move the display from one vehicle to another.

Note *– If you restore the defaults, the Autopilot vehicle setup information is not reset.*

To restore the default settings:

1. At the *Configuration* screen, select the System option and then tap **Setup**. The *Display Setup* screen displays.
2. Tap **Default**. A confirmation screen displays.
3. Tap **Yes**. The default settings are restored.

Signal input module for OEM switch



The signal input module (SIM) can interface with existing equipment inputs to control on-screen buttons and features. A SIM must be connected to assign features to the buttons.

1. To assign the buttons, highlight the action in the Actions list.
2. Tap **<-- Set** to set the action to the specified input.

Sounds

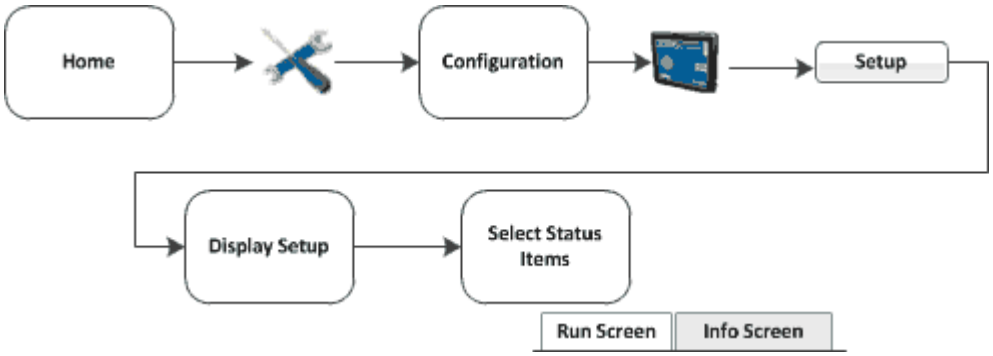
The ways sounds can be produced are:

- Through the internal speaker of the FM-1000 integrated display
- If Autopilot is part of your configration, you can use an exernal Sonalert

1. At the *Display Setup* screen, select Sounds and tap setup.
2. Complete the settings and tap **OK**.

Setting	Explanation
Alarm	Off, External Speaker, AP Sonalert. ***Note*** *– Sonalert works only with Autopilot.*
Warning	Off, External Speaker, AP Sonalert. ***Note*** *– Sonalert works only with Autopilot.*
Track Logging	Off, External Speaker
Touch Screen	Both high, Off, External low

Status items

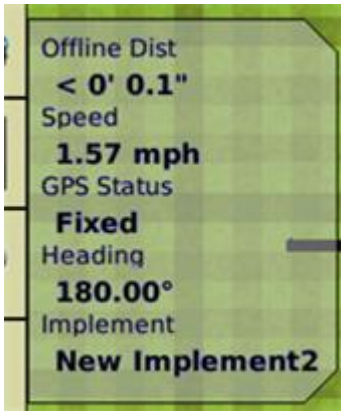


The status items are features you have activated for use. See Activate features/plugins for use (page 45). If a feature is deactivated, the status items associated with it are no longer available.

The *Select Status Items* screen has two tabs where you can configure various display options for the status text items.

Run screen slide-out status

On the Run Screen tab, you can set what items display on the *Run* screen in the status slide-out panel when you tap the edge of the panel. The status text items appropriate for the features/plugins you are currently using display in the *Info Items* list.



1. Set the upper left status text item:
   a. From the Info Items list, tap the item you want to use.
   b. Tap the left **^ Set Item** button. The information displays in the upper left field.
2. Set the upper right status text item:
   a. From the Info Items list, tap the item you want to use.
   b. Tap the right **^ Set Item** button. The information displays in the upper right field.

3. From the Timeout list, select a time. This is how long the tab remains on-screen before retracting. To have the tab extended until you close it manually, select Never.
4. To add status items to the slide-out tab:
   a. Tap the position on the tab that you want to fill. For example, to add an item to the first position on the list, tap at the location shown.
   b. From the Info Items list, tap the item you want to use.
   c. Tap **<- Set Item.**
5. To save the configuration, tap **OK**.

Info screen

On the Info Screen tab, you can determine which items will be displayed on the Info panel when you tap .

The status text items appropriate for the features/plugins you are currently using display in the Info Screen list.

1. Set the left Info text items:
   a. From the Info Items list, tap the item you want to use.
   b. Tap the left **^ Set Item** button.
   c. Repeat steps a and b until you have all the items you want, or the list is full. The information displays in the left field.
2. Set the right Info text items:
   a. From the Info Items list, tap the item you want to use.
   b. Tap the right **^ Set Item** button.
   c. Repeat steps a and b until you have all the items you require, or the list is full. The information displays in the right field.
3. To save the configuration, tap **OK**.

Status option list

The following list shows the status items you can choose to display on the *Run* screen. The status items available depend on the optional features/plugins that are currently activated.

In the *Display Setup* screen, select **Status Items** and then tap **Setup**.

Status Item	Explanation
(blank)	Status text item is not shown
Along Track Error	

Status Item	Explanation
Altitude	Current height of the vehicle
Applied Rate	Current application rate
Area to Empty	Area that can still be applied before the tank is empty
Auxiliary Valve	Current status of the auxiliary valve
Available Memory	Amount of free space on the display's internal memory
Average Population	Average rate across all rows
Avg Seed Spacing	Average distance between seeds based on the average sample size
Blade Height	Current height of the blade
Boot Depth	Depth of the boot when installing tiles or the depth of the blade when cleaning surface ditches (used with the Autoslope leveling model)
CH1 - CH4 Product Level	Current level of the products that are in channels 1-4
Client Name	Name of the current client
CMR Percent	Percentage of radio CMR packets received over the last 100 seconds
Control Speed	Speed reported to the multi-application controller
Correction Age	Length of time since the last correction was received
Correction Type	Correction type that is being used
Coverage Percent	Percentage of the field area that is covered area
Current Flow	Current flow of material
Cut/Fill	Difference between the Blade Height and the Target Height: • When Cut is shown, the current ground height is above the target height. The height adjustment indicator shows a red down arrow, which means that the blade needs to move down to reach the Target Height. • When Fill is shown, the current ground height is below the target height. The height adjustment indicator shows a red up arrow, which means that the blade needs to move up to reach the Target Height.
Design Height	Height the blade will attempt to reach. This is the Design Height ± the Offset. When the blade reaches the Target Height, the arrows turn green.

Status Item	Explanation
Design Slope	When using the Autoslope leveling model, this displays the design slope with respect to the current location along the section line.
Dist to Feature	Distance to the nearest feature
Dist to Pause	Distance to the pause position
East	Distance that the vehicle is to the east of the field origin point (a negative number means the vehicle is to the west of the field origin point)
Engaged Time	Length of time that the system has been engaged
Event Coverage Area	Area that has been logged during the current event
Event Coverage Distance	Distance covered while logging during the current event
Event Coverage Time	Length of time that coverage logging has been engaged during the current event
Event Name	Name of the current event
Farm Name	Name of the current farm
Field Area	Field area within a pivot or headland boundary
Field Name	Name of the current field
Free External Storage	Amount of free space on the USB drive
Free Internal Storage	Amount of free space on the display's internal memory
GMT Time	Current Greenwich Mean Time
GPS Position Spacing	
GPS Status	GPS correction type that the GPS receiver is currently using
H Error	Horizontal error:An estimation of the level of precision of the GPS position in 2 dimensions
Heading	Current heading of the vehicle, in degrees, from direct north
Heading to Feature	Vehicle location relative to the nearest feature (feature is directly ahead = 0°; directly behind = 180°)
Heading to Pause	Direction vehicle is facing relative to the paused vehicle position (directly ahead = 0°; directly behind = 180°)
Impl. Altitude	Current height of the implement
Impl. CMR Percent	Percentage of radio CMR packets received by the implement GPS

Status Item	Explanation
	receiver over the last 100 seconds
Impl. Correction Age	Age of the corrections used by the implement receiver
Impl. Correction Type	Correction type used by the implement receiver
Impl. East	Distance that the implement is to the east of the field origin point (a negative number means the implement is to the west of the field origin point)
Impl. Engaged Time	Time that the implement has been engaged
Impl. GPS Status	The status of the GPS correction used for the implement
Impl. H Error	Implement horizontal error: An estimation of the level of precision of the implement GPS position in 2 dimensions
Impl. HDOP	Horizontal Dilution of Precision of the implement receiver: A measure of accuracy based on the geometry of the satellites in the sky. If the satellites are near each other in the sky, the HDOP is higher (lower is better).
Impl. Heading	Current heading of the implement, in degrees, from direct north
Impl. Latitude	Implement's current latitude
Impl. Long-Term XTE	Implement Cross Track Error (XTE) when passes occur more than one hour apart
Impl. Longitude	Implement's current longitude
Impl. Network ID	RTK network ID of the implement receiver's corrections
Impl. North	Distance that the implement is to the north of the field origin point (a negative number means the implement is to the south of the field origin point)
Impl. Nudge/Trim	Amount of nudge or trim currently applied to the implement position
Impl. Offline Dist	Distance away from the guidance line
Impl. Satellites	Number of satellites the implement receiver is reading
Impl. Short-term XTE	Implement pass-to-pass Cross Track Error (XTE) when passes occur within less than 15 minutes
Impl. Speed	Current implement speed

Status Item	Explanation
Impl. Steering Angle	Steering angle of the implement
Impl. Up	Vertical height of the implement relative to the field origin point (a negative number means the implement is lower than the field origin point)
Impl. Vehicle Model	Implement profile name
Implement	Name of the current implement
Implement F/B Offset	Distance of front to back offset
Implement L/R Offset	Distance of left to right offset
Implement Width	Width of the implement
Latitude	Vehicle's current latitude
Line Feature Length	Length of the current line feature
Local Time	Current local time
Long-term XTE	Vehicle Cross Track Error (XTE) when passes occur more than one hour apart.
Longitude	Vehicle's current longitude
Longitude	Vehicle's current longitude
NDVI	Normalized Difference Vegetation Index
Nearest Point Name	Bame of the nearest point feature
Network ID	RTK network ID of the GPS receiver's corrections
Network Status	Current status of the wireless cellular network
North	Distance that the vehicle is to the north of the field origin point (a negative number means the vehicle is to the south of the field origin point)
Nudge	Amount of nudge currently applied
Nudge/Trim	Amount of nudge or trim currently applied
Offline Dist.	Distance away from the guidance line
Offset X	Relative Position X offset from the master benchmark
Offset Y	Relative Position Y offset from the master benchmark
P Altitude	Current height of the vehicle as reported by the primary blade GPS

Status Item	Explanation
	receiver
P Blade Height	Current height of the primary blade
P Boot Depth	Depth of the boot when installing tiles or the depth of the blade when cleaning surface ditches (used with the Autoslope leveling model)
P CMR Percent	Percentage of radio CMR packets received over the last 100 seconds by the primary blade GPS receiver
P Correction Age	Time since the GPS corrections were last received from the primary FieldLevel™ GPS receiver
P Correction Type	Correction type used by the primary blade receiver
P Cut/Fill	Difference between the Primary Blade Height and the Primary Target Height: • When Cut is shown, the current ground height is above the target height. The height adjustment indicator shows a red down arrow, which means that the blade needs to move down to reach the Target Height. • When fill is shown, the current ground height is below the target height. The height adjustment indicator shows a red up arrow, which means that the blade needs to move up to reach the Target Height.
P Design Height	Height the primary blade will attempt to reach. This is the Design Height ± the Offset. When the blade reaches the Target Height, the arrows turn green.
P Design Slope	When using the Autoslope leveling model, this displays the design slope with respect to the current location along the section line.
P Distance Traveled	Distance traveled since Auto mode was enabled. (For use with FieldLevel II Point to Slope mode). The d
P East	Distance that the primary blade receiver is to the east of the field origin point (a negative number means the receiver is to the west of the field origin point)
P GPS Status	GPS correction type that the primary blade GPS receiver is currently using
P H Error	(Horizontal error) An estimation of the level of precision of the primary blade GPS position in 2 dimensions

Status Item	Explanation
P HDOP	Horizontal Dilution of Precision of the primary blade receiver: A measure of accuracy based on the geometry of the satellites in the sky. If the satellites are near each other in the sky, the HDOP is higher (lower is better).
P Heading	Current heading of the primary blade, in degrees, from direct north
P Latitude	Primary blade's current latitude
P Longitude	Primary blade's current longitude
P Network ID	RTK network ID of the primary blade receiver's corrections
P North	Distance that the primary blade receiver is to the north of the field origin point (a negative number means the receiver is to the south of the field origin point)
P Offset	Separate plane that is parallel to the design plane. The offset if defined by a single measurement, which is the height that the offset plane is from the design plane.
P Offset X	Relative Position X offset from the master benchmark
P Offset Y	Relative Position Y offset from the master benchmark
P Satellites	Number of satellites the system is currently being received by the FieldLevel II GPS receiver
P Section Line Number	Line number of the primary blade
P Speed	Speed of the vehicle as reported by the primary blade GPS receiver
P Target Height	Height the primary blade will attempt to reach. This is the Design Height ± the Offset. When the blade reaches the Target Height, the arrows turn green.
P Up	Height of the primary blade receiver relative to the field origin point (a negative number means the blade is lower than the field origin point)
P VDOP	Vertical Dilution of Precision of the FieldLevel II GPS receiver: A measure of accuracy based on the geometry of the satellites in the sky. If the satellites are near each other in the sky, the VDOP is higher (lower is better).
P Vertical Error Estimate	Current estimate of error in the height calculated by the FieldLevel II GPS receiver
Pressure	Current pressure as reported by the primary pressure sensor

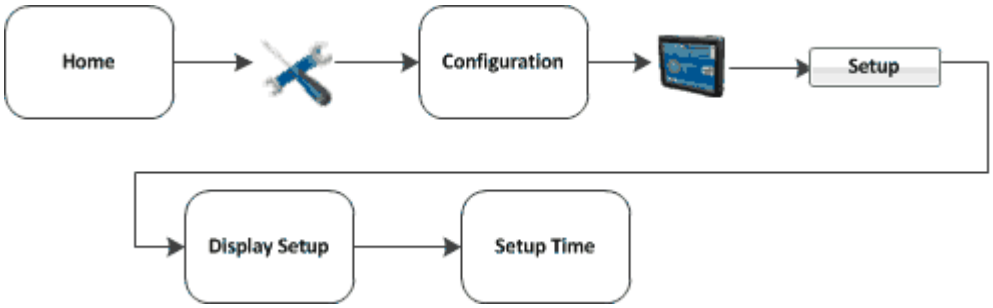
Status Item	Explanation
Productive Area	Area of Area Features that are designated as "productive"
Radio Signal Strength	DCM-300 wireless signal strength
S Altitude	Current height of the vehicle as reported by the secondary blade GPS receiver
S Blade Height	Current height of the secondary blade
S CMR Percent	Percentage of radio CMR packets received over the last 100 seconds by the secondary blade GPS receiver
S Correction Age	Time since the GPS corrections were last received from the secondary FieldLEvel GPS receiver
S Correction Type	Correction type used by the secondary blade receiver
S Cut/Fill	Difference between the Secondary Blade Height and the Secondary Target Height: • When Cut is shown, the current ground height is above the target height. The height adjustment indicator shows a red down arrow, which means that the blade needs to move down to reach the Target Height. • When Fill is shown, the current ground height is below the target height. The height adjustment indicator shows a red up arrow, which means that the blade needs to move up to reach the Target Height.
S Design Height	Height the secondary blade will attempt to reach. This is the Design Height ± the Offset. When the blade reaches the Target Height, the arrows turn green.
S Distance Traveled	Distance traveled since Auto mode was enabled (for use with FieldLevel II Point to Slope mode)
S East	Distance that the secondary blade receiver is to the east of the field origin point (a negative number means the receiver is to the west of the field origin point)
S GPS Status	GPS correction type that the secondary blade GPS receiver is currently using
S H Error	(Horizontal error) Estimation of the level of precision of the secondary blade GPS position in 2 dimensions
S HDOP	Horizontal Dilution of Precision of the secondary blade receiver: A measure of accuracy based on the geometry of the satellites in the

Status Item	Explanation
	sky. If the satellites are near each other in the sky, the HDOP is higher (lower is better).
S Heading	Current heading of the secondary blade, in degrees, from direct north
S Latitude	Secondary blade's current latitude
S Longitude	Secondary blade's current longitude
S Network ID	RTK network ID of the secondary blade receiver's corrections
S North	Distance that the secondary blade receiver is to the north of the field origin point (a negative number means the receiver is to the south of the field origin point)
S Offset	Separate plane that is parallel to the design plane. The offset if defined by a single measurement, which is the height that the offset plane is from the design plane.
S Offset X	Relative Position X offset from the master benchmark
S Offset Y	Relative Position Y offset from the master benchmark
S Satellites	Number of satellites the system is currently being received by the FieldLevel II GPS receiver
S Section Line Number	Line number of the secondary blade
S Speed	Speed of the vehicle as reported by the secondary blade GPS receiver
S Target Height	Height the secondary blade will attempt to reach. This is the Design Height ± the Offset. When the blade reaches the Target Height, the arrows turn green.
S Up	Height of the secondary blade receiver relative to the field origin point (a negative number means the blade is lower than the field origin point)
S VDOP	Vertical Dilution of Precision of the FieldLevel II GPS receiver: A measure of accuracy based on the geometry of the satellites in the sky. If the satellites are near each other in the sky, the VDOP is higher (lower is better).
S Vertical Error Estimate	Current estimate of error in the height calculated by the FieldLevel II GPS receiver
Satellites	Number of satellites the system is currently receiving

Status Item	Explanation
Secondary Pressure	Current pressure, as reported by the secondary pressure sensor
Section Line Number	Number of the current section line
Seed Mults %	Percentage of time an more than one seed is placed for every intended drop
Seed Population	Amount of seed planted per acre/hectare
Seed Singulation	Percentage of time an individual seed is placed for every intended drop
Seed Skips %	Percentage of seed that has not been planted
Seed Spacing	Percentage of seed that has been applied in the specified spacing
Session Coverage Area	Area that has been logged during the current session
Session Coverage Dist	Distance covered while logging during the current session
Session Coverage Time	Length of time that coverage logging has been engaged during the current session
Session Time	Length of the current field session
Short-term XTE	Vehicle pass-to-pass Cross Track Error (XTE) when passes occur within less than 15 minutes
Speed	Current vehicle speed
Steering Angle	Angle reported by the rotary potentiomenter or the AutoSense™ device
Survey Area	Total area of the current survey
Survey Cut/Fill	Difference between the Blade Height and the Target Height: • When Cut is shown, the current ground height is above the target height. The height adjustment indicator shows a red down arrow, which means that the blade needs to move down to reach the Target Height. • When Fill is shown, the current ground height is below the target height. The height adjustment indicator shows a red up arrow, which means that the blade needs to move up to reach the Target Height.
Survey Points	Number of survey points that have been created
Swath Length	Length of the current guidance line

Status Item	Explanation
	Note *– FreeForm™ curves are made up of line segments, so the Swath Length value is not appropriate for FreeForm curves.*
Swath Number	Swath number (L = left, R = right) ***Note*** *– FreeForm curves are made up of line segments, so the Swath Number value is not appropriate for FreeForm curves.*
Swath Points	The number of points that define the current line.
Tank Level	Current level of the tank
Tank Level N	Level of nitrogen currently in the tank
Tank Level NH3	Level of anhydrous ammonia currently in the tank
Tank/Bin Level	Current level of the tank or bin
Target Rate	Application target rate
Total Boundaries Area	Total area between the current boundaries
Total Seed Rate	Total seed rate that is currently being applied
Total Vol Applied	Total volume of material applied
Total Vol Applied N	Total volume of nitrogen applied
Total Vol Applied NH3	Total volume of anhydrous ammonia applied
Transfer Status	Connected Farm™ transfer activity
TrueGuide Roll	Roll corrections in degrees that are applied
TrueGuide Trim	Distance from the guidance line that the vehicle has been shifted
Up	Vertical height of the vehicle relative to the field origin point (a negative number means the vehicle is lower than the field origin point)
VDOP	Vertical Dilution of Precision of the FieldLevel II GPS receiver: A measure of accuracy based on the geometry of the satellites in the sky. If the satellites are near each other in the sky, the VDOP is higher (lower is better).
Vehicle Model	Model of vehicle that is configured
Vehicle Type	Type of vehicle that is configured
Vertical Error Estimate	Current estimate of error in the height calculated by the FieldLevel II GPS receiver

Time setup



Note *– When you configure the time zone, multiple warning messages may display. Do not be concerned by this.*

To synchronize the system time to the GPS signals:

1. From the *Display Setup* screen, tap Timezone.
2. Tap **Setup**. If the time is not correct, tap the **-** or **+** button to change the time by 1-hour increments.

CHAPTER 4

Data management

In this chapter:

Managing data **78**

Transfer data **78**

Delete data **81**

Data storage structure **83**

Data Dictionary categories **94**

This chapter explains:

- How to transfer data between a USB drive and the display
- The structure of data on the USB and computer
- The Data Dictionary

Managing data

As part of data management, you can:

- Transfer files. See Transfer data (page 78).
- Delete files. See Delete data (page 81).
- Edit and add to the data entry categories by editing the data dictionary. See Data Dictionary categories (page 94).
- Create or load a data dictionary. See Create / load a data dictionary (page 95).
- View a PDF file of an event summary. See Event subfolder (page 87).
- Import an AB line or boundary. See Import AB Lines or boundaries (page 337).
- Save an Autopilot system vehicle configuration file (.vdb). See Save vehicle profile (page 165).

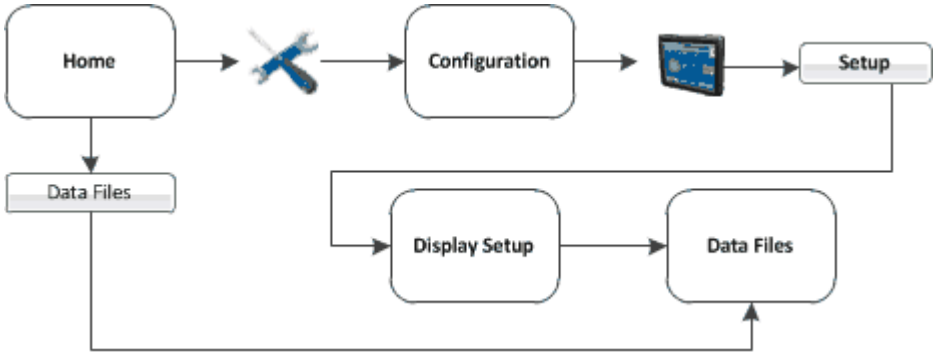
Files generated by the FM-1000 integrated display are saved in a specific structure on the USB drive. See Data storage structure (page 83).

Transfer data

At the *Data Files* screen, you can:

- Transfer data between a USB drive and the display's internal storage. See Display to USB (page 79) or Transfer from USB (page 80).
- Transfer data between a USB drive and a computer. See USB to computer (page 80).
- Delete data from a USB drive or the display's internal storage. See Delete data (page 81).

Data Files screen



You can access the *Data Files* screen from either:

- The *Home* screen: Tap **Data Files**.
- The *Configuration* screen:
  a. At the ***Home*** screen, tap .
  b. At the *Configuration* screen, tap System and then tap **Setup**.
  c. If necessary, enter the administration password and then tap **OK**.
  d. Select Data Files from the list and then tap **Manage**. The *Data Files* screen displays.

Data File categories

The categories available on the Data Files screen are:

Category	Subcategories and data
Summary Files	PDF summary files listed under client name
Diagnostics	Screen shots: Folder containing screen captures System logs
Configuration	Features: Implements: System Archive: Varieties: Vehicle Archive:
Data Dictionary	Data dictionary (see Data Dictionary categories (page 94))
Field Data	Data for all activities in the field. Data is structured as: Client / Farm / Field / Event

Display to USB

CAUTION – Do not remove the USB drive from the socket while the application is copying data. This will corrupt the data.

CAUTION – POTENTIAL LOSS OF DATA!
If you copy files from:
- An to another or to an FM-1000 integrated display.
- An physical FM-1000 integrated display to another or to an FM-1000 integrated display
First make sure you have created a subfolder labeled with the display serial number for your files. Transfer your files to this subfolder. Otherwise, you will overwrite files when you copy and you will corrupt your data.

1. At the *Data Files* screen from the display's Internal Storage list, tap the item to copy. You can:
   - Select all files in the category: Select the entire category by tapping the category name.
   - Select individual files: See files within a category by tapping . The arrow changes to a down arrow and shows the files stored under the category. Then select the file or files you want.
   - Select all files: Select Everything.
2. Tap **Copy >**. The item is copied to the USB list.

Transfer from USB

CAUTION – Do not remove the USB drive from the socket while the application is copying data. This will corrupt the data.

CAUTION – POTENTIAL LOSS OF DATA!
If you copy files from:
- An to another or to an FM-1000 integrated display.
- An physical FM-1000 integrated display to another or to an FM-1000 integrated display

First make sure you have created a subfolder labeled with the display serial number for your files. Transfer your files to this subfolder. Otherwise, you will overwrite files when you copy and you will corrupt your data.

1. At the *Data Files* screen from the USB list, tap the item to copy. You can:
   - Select all files in the category: Select the entire category by tapping the category name.
   - Select individual files: See files within a category by tapping . The arrow changes to a down arrow and shows the files stored under the category. Then select the file or files you want.
   - Select all files: Select Everything.
2. Tap **Copy >**. The item is copied to the Internal Storage list.

USB to computer

After you have transferred data from the display to the USB:

1. Remove the USB drive from the display.
2. Insert the USB drive into your computer.

If you place the files in a series of folders, the combined filename and folder path may become too long and the operating system may not allow you to open the files. To avoid this, it is recommended that you place data in your computer's C:\ folder.

3. Copy the appropriate folder to the office computer using an application such as Windows® Explorer. This copies all the sub-folders and files in the folder.

   Note *– When you copy or move files using Windows Explorer, you must keep all the shape-files (.dbf, .shp, and .shx) together so that office software can open the theme file. To ensure that the files stay together, always copy the entire folder rather than just the individual files.*

4. If you create a new event in a field, and you already have the\Field\ folder containing any previous events on the office computer, you should still copy the \Field\ folder so that the new EventHistory information is copied.

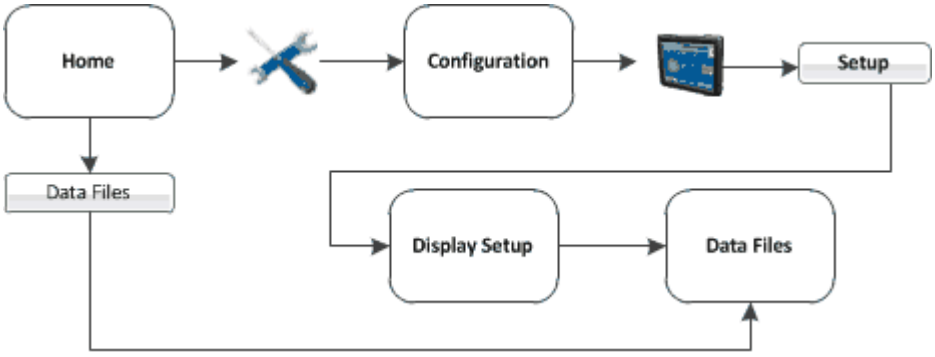
Delete data

CAUTION – Deleting data is permanent. You cannot undo the deletion or restore the data.

If you need to create more space, you can use the FM-1000 integrated display to delete from the internal memory or the USB drive:

- Clients
- Farms
- Fields
- Events

Note *– You cannot undo data deletion or restore the data.*



1. At the *Data Files* screen, tap **Delete Data**. The *Delete Data Storage* screen displays.
2. If you want to delete from:

- The internal memory of the display: Tap the Internal tab.
- The USB drive: Tap the USB Drive tab.

3. To delete a specific item:
   a. In the lists for Client, Farm, Field or Event, tap the item you want to delete.
   b. Tap **Delete**.
   c. To exit the *Delete Data Storage* screen, tap **OK**.
4. To delete all materials:
5. To delete all events:
   a. Tap **Delete All Events**.
   b. Enter the administration password.
6. To delete all files on the display:
   a. Tap **Delete EVERYTHING**.
   b. Enter the administration password.
7. The system displays a message asking you to confirm the deletion. If you want to proceed, tap **Yes**.

Data storage structure

The FM-1000 integrated display stores client, farm, field, and event data in a specific structure on the computer and USB drive. The first level folder is AgGPS.

Depending on your system configuration and the operations you perform, the top level folders of the structure are:

- AB Lines folder (page 83)
- Archives folder (page 84)
- Autopilot folder (page 84)
- Data folder (page 84)
- Data Dictionary folder (page 91)
- Diagnostics folder (page 91)
- Prescriptions folder (page 92)
- Summaries folder (page 92)
- Task Data folder (page 94)

AB Lines folder

There is one set of boundary and AB Line shapes for each field:

- Boundary.* - Fields with boundaries include a boundary polygon stored in the boundary.shp file. Fields without boundaries do not contain a boundary file.
- Swath.* - For fields with boundaries, AB polylines are stored in the swath.shp file.

Note *– Units are always metric in files created by the display.*

The following is stored in the boundary and AB line attribute files.

Column	Field Description	Format
Area	Field area (Boundary area)	ha
Date	Date the field was created	YYYYMMDD
Dist1		
Dist2		
ID	AB Line number ID	
Length	Length of the AB Line	meters

Column	Field Description	Format
Name	Name assigned to the AB Line	
Perimeter	Field perimeter distance (Boundary only)	meters

The size of the field is not defined unless a field has a boundary. Therefore, the %_Complete in the EventHistory.dbf file is always zero for fields without boundaries

Note – *If you browse the .dbf files using an Excel spreadsheet, date fields may appear in a different format, depending on your local settings.Unless a field has a boundary, the size of the field is not defined. Therefore, for fields without boundaries the %_Complete in the EventHistory.dbf file is always zero.*

Archives folder

When the ProgramLog.txt file becomes larger than 1024 KB, it is backed up to a file named ProgramLog.old and stored in the Archives folder.

Autopilot folder

The Autopilot folder contains the following subfolders:

- Configuration
- Custom Vehicle Configurations
- VDB
- Vehicle Database

Data folder

The data folder contains the client subfolder and all subsequent subfolders related to the client.

Client subfolder

The client is the customer for whom the work is being done. This folder contains at least one Farm subfolder for each client.

Farm subfolder

A farm is a collection of fields. This folder contains at least one Field subfolder related to each farm.

Field subfolder

You create an on-screen field to represent an actual field, part of an actual field, or a group of more than one actual fields.

This folder contains an Event subfolder for each event performed on the field as well as the following files:

Data	Explanation	Files
Field AB Line	Boundary and/or AB Line polylines	Swaths.shp Swaths.dbf Swaths.shx
Field Boundary	Polygon (Only available if the field is a headland field and therefore has a boundary)	Boundary.shp Boundary.dbf Boundary.shx
Coordinates	Contains coordinates of the field boundary file	<Latitude Longitude Altitude>.pos
Paused Files	Information regarding guidance being paused	
Event history	Information about each event carried out in the field	EventHistory.dbf Version / Client / Farm / Field / Event / Operator / Material / Date Open / Time Open / Date Close / Time Close / Duration / Primary AB / ABLine / Cover Area / Cover Distance / Cover Time / Engage Time
Point features	Attribute ID and latitude, longitude, and height	PointFeature.shp PointFeature.dbf PointFeature.shx
Line features	Line with attribute ID	LineFeature.shp LineFeature.dbf LineFeature.shx
Area features	Area polygons with attribute ID	AreaFeature.shp AreaFeature.dbf AreaFeature.shx

Event History file

The EventHistory.dbf file contains information on every event carried out in the field.

Data	Explanation
ABLine	Guidance line used
Client	Client name
Cover area	Area covered
Cover distance	Distance covered
Cover time	Total time to cover the covered area
Date close	Date the field was closed
Date open	Date the field was opened
Duration	Length of time that the field was open (seconds)
Engage time	Time engaged
Event	Event name
Farm	Farm name
Field	Field name
Material	Material name
Operator	Operator name
PrimaryAB	Number of the primary AB Line
Time close	Time the field was closed
Time open	Time the field was opened
Version	FM-1000 integrated display firmware version

Data in features file

One row of data is stored in the <type>.dbf file for each feature of that feature type recorded in the field.

Data	Explanation	Format / Notes
Area	Field area (Area only)	ha
Date	Date the feature was created.	yyyy/mm/dd
Dist1		
Dist2		

Data	Explanation	Format / Notes
ID	Feature ID	
Length	Length of the AB Line.	meters
Name	Feature name	
Perimeter	Field perimeter distance (Area only)	meters
PrefWeight		
SwathsIn		
Time	Time the feature was recorded.	hh:mm:ss.s
Version	Features attribute file version.	

The following data is only recorded in point features.

Data	Explanation	Format / Notes
AlarmRad	Alarm radius	meters
Height	Ground mean sea level height at antenna position. If you are mapping on a slope, the height may be wrong.	meters
Latitude	Antenna latitude	decimal degrees
Longitude	Antenna longitude	decimal degrees
Status_Txt	GPS status	meters
WarningRad	Warning radius	meters

Event subfolder

An event is a precision agriculture application or activity on a particular field. For example:

- Planting of seed
- Application of fertilizer or lime
- Spraying with fungicide, herbicide, or insecticide

Files stored in this folder are:

Data	Explanation	Files
Coverage	Graphical files containing polygons	Coverage.shp Coverage.dbf Coverage.shx
Track	Graphical files containing a series of 3D points with attributes	Track3D_<*date time*>.shp Track3D_<*date time*>.dbf Track3D_<*date time*>.shx
Free Form Guidance	Graphical files containing paths for free form guidance	Swaths.shp Swaths.shx Swaths.dbf

Coverage logging file

The display creates a coverage logging file when any application coverage is recorded. For each coverage polygon, the following information is saved to the coverage logging file.

Data	Field Description
AppType	Application type ID
AppliedRate	Applied rate reported by the variable rate controller
DateClosed	Date the polygon was closed
GPS_Status	Numeric GPS status value
Height	Height in meters
Speed	Average GPS ground speed for the polygon (in meters per second)
Status_Txt	GPS status description
Swath	The current swath number when coverage was recorded
TimeClosed	Time the polygon was closed
Version	Coverage attribute file version
XTE	Implement Cross Track Error (in meters)

Track logging file

A track logging file is created whenever the event is opened. At each point, a number of attributes are recorded.

The units stored in the track attribute file (Track3D_<date time>.dbf) are in metric units.

Also see: Map settings (page 54).

Data	Field Description	Format / Notes
Along_Line	Along Line distance from start of swath	meters
Ant_HAE	Antenna height above ellipsoid	meters
Ant_Lat	Antenna latitude (WGS-84)	DD.dddddddd
Ant_Long	Antenna longitude (WGS-84)	DD.dddddddd
Appln_Wdth	Application width	meters
As applied	The actual rate applied by the rate control system when serial rate control, TAC or the Field-IQ system are used	
Auto_Steer	Auto-Steer Flag (1=on, 0=off)	On or off
Corct_Age	DGPS signal correction age	seconds
DOP	Horizontal Dilution of Precision – a measure of the quality of positions based on satellite geometry	–
Field_Name	Name of the field	–
GPS_Status	GPS status value	1 to 12
Ground_HAE	Ground height above ellipsoid	meters
Heading	Direction of travel with respect to true North.	decimal degrees
Height	Mean sea level height of ground	meters
Local_Time	Local time	hh:mm:ss.s
Logging_On	Coverage logging Flag (1=on, 0=off)	On or off
NDVI	The NDVI values recorded when using the GreenSeeker plugin (not currently implemented)	
Num_Stats	Number of GPS satellites	–
Offline	Offline distance from swath center line	meters
Pitch	The pitch	–
Relative_Height	Height	meters
Roll	The roll	–
Speed	GPS derived ground speed	kph
Status_Text	GPS status description	–

Data	Field Description	Format / Notes
Swath_Num	Current swath/headland number	
Swath_wdth	Swath width	meters
Target	Target rate at the current position	–
Target	Target application rate when serial rate control, TAC or the Field-IQ system are used	
Total_Qty	Total volume of material as applied for the current field Only supported for the: • Aerial Flow Controller • Autocal Flow controller • Crophawk Flow Meter	–
TRACK_ID	Date and time stamp	–
Units	Units	metric
UTC_Date	Point creation date	YYYYMMDD
UTC_Time	UTC time	hh:mm:ss.s
Version	Track attribute file version	–
Yaw	The yaw	–

Graphical data formats

The FM-1000 integrated display uses the Environmental Systems Research Institute (ESRI) 3D shape-file format for storing the layers of graphical information collected in the field (for example, spray coverage, track logging points, and features). The three files in a shapefile set are:

- <filename>.dbf file: Contains the feature attributes
- <filename>.shp file: Contains position information
- <filename>.shx file: An index file that links the position information with its attributes

The term *shapefile* is used to refer to these three files collectively.

The display records all latitude, longitude, and height data in decimal degrees.

***Note** – The display reads and writes ESRI ArcView version 2.0 or 3.1 3D polylines, polygons, and points. The M and Z entity types introduced in ArcView 3.1 can be generated in the track logging files, but cannot be read by the display. For more information, visit the ESRI website (www.esri.com).*

Graphical file editing

ESRI shape (.shp) and attribute (.dbf) files can be used in many other software packages that can import or use .shp and .dbf formats.

The Farm Works Software® is recommended. For more information, go to www.farmworks.com.

Data collected by the display can be opened directly into the Farm Works software. You can make changes to the files and save them on an office computer.

The Microsoft Excel® spreadsheet software and most database software also let you open and view the data in the attribute (.dbf) file.

The display can load files that you created in office software. Save Shapefile or Agfile (.gdx) prescriptions to the \AgGPS\Prescriptions\ folder on the USB drive to send rates to a variable rate controller.

Data Dictionary folder

The Data Dictionary folder contains text files you can add to customize the data dictionary. See Data Dictionary categories (page 94) and Create / load a data dictionary (page 95).

Diagnostics folder

Diagnostic logs are stored for the FM-1000 integrated display and activities. Logs are useful for Trimble Support to troubleshoot system operation issues.

The ProgramLog.txt file is saved in the Diagnostics folder and can be useful for troubleshooting. This file contains data from checks performed by the FM-1000 integrated display:

- When the display is turned on or off
- Periodically, while running

The file can be read with a text editor such as Notepad.

When this file becomes larger than 1024 KB, it is backed up to a file named ProgramLog.old and stored in the Archives folder. See Archives folder (page 84).

The Diagnostics folder contains the following subfolders:

- Autopilot (if you are using the Autopilot system)
- Preferences: System settings stored in the <Preferences>.xml file
- Screenshots: Screenshot files automatically numbered Screenshot_<num>.png
- gps
- logs
- Screenshots

Autopilot subfolder

This folder contains Autopilot configuration settings (vehicle.cfg).

Screenshots folder

The Screenshots folder contains screenshots you have captured.

System folder

The system folder contains log files used in troubleshooting.

Program log files

The ProgramLog.txt file can be useful for troubleshooting. This file contains data from checks performed by the FM-1000 integrated display:

- When the display is turned on or off
- Periodically, while running

When this file becomes larger than 1024 KB, it is backed up to a file named ProgramLog.old and stored in the Archives folder. See Archives folder (page 84).

The file can be read with a text editor such as Notepad.

Prescriptions folder

For each prescription that you generate, the system stores three prescription files in either of these formats:

- ESRI shape-file format:
  - <prescription_name>.shp
  - <prescription_name>.dbf
  - <prescription_name>.shx
- .gdx file format:
  - <prescription_name>.gdx

Some GIS software packages generate other files and include different contents in the files. If these files are on the USB drive, they are ignored when you transfer from the USB to the display.

Summaries folder

The Summaries folder contains files such as:

- Program log files
- PDF summary file

PDF summary file

When you close a field, the display creates a PDF summary file. This file is saved to the folder: \AgGPS\Summaries\<client_farm_field_event>\.

The Event Summary PDF file may include the following images of the field:

- Overlap: Coverage and any overlaps
- Height: Vertical height of the GPS position
- Applied rate: Volume at which the spray boom applied solution
- GPS quality
- Average XTE coverage layer: Degree of implement drift

The file also shows information about the:

- Event
- Vehicle setup

To view a summary report on a computer:

1. Remove the USB drive from the display.
2. Insert the USB into an office computer.
3. Select the folder \AgGPS\Summaries\.
4. Open the file Index.html.

Note *– If you use the Microsoft® Internet Explorer® Internet browser, you may need to allow ActiveX® technology to see all of the summary file.*

Task Data folder

The TaskData folder contains yield data collected in the ISO11783 BIN format, which is read by Farm Works and other precision agriculture software.

Data Dictionary categories

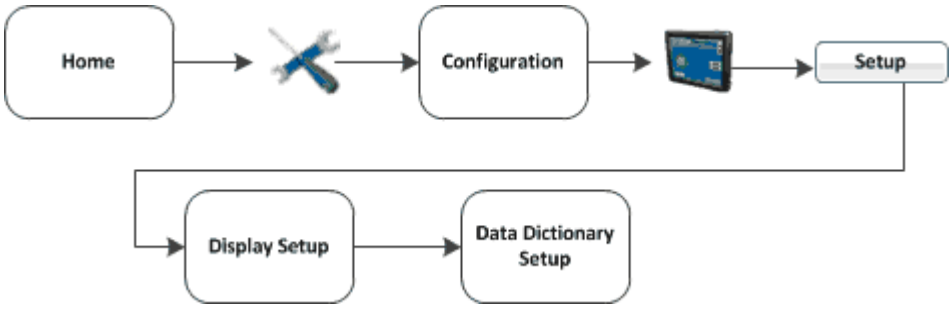
The data dictionary editor enables you to edit default data entry categories and add new ones.

Default data entry categories

The following are default categories in the Data Dictionary.

- Application method
- Client
- Crop
- Custom 1, 2, 3 and 4
- Event
- Farm
- Farm location
- Field
- Harvest
- Harvest year
- Implement
- Material
- Operator
- Operator EPA#
- Sky conditions
- Soil conditions
- Soil type
- Stoppage reason
- Target pests
- Vehicle
- Wind direction
- Wind gust speed
- Wind speed

Edit data entry categories



1. At the *Display Setup* screen, tap Data Dictionary.
2. Tap **Setup**. The *Data Dictionary Setup* screen displays.
3. From the data list, select the data item you want to add or change.

- Tap **New** to create a new item.
- Tap **Edit** to change an existing item.

4. Define the custom entry by manually entering or updating the name, then tap **OK**.
5. The new or edited entry displays in the data list on the *Data Dictionary Setup* screen.

Create / load a data dictionary

The FM-1000 integrated display can load data dictionaries that enable you to select field entry data (for example, Client, Farm, Field, and Event) from a list of predefined values. This saves you time from continually entering commonly used categories.

You can create a data dictionary either through the display or using Farm Works software.

To create a data dictionary on a computer:

1. On a computer, create a text file. The text file can have any name, but the file extension must be .txt.
2. Enter the text.
3. Copy the .txt file to the \AgGPS\Data Dictionary\ folder on a USB drive.
4. On specific display screens (for example, at the *Client* screen), the file entries will display.
5. To access the entries in the dictionary:
   a. At the *Field Setup* screen, tap **New**.
   b. Tap any list's down arrow to see the available items in the list.
   c. Select the appropriate item from the list.
   d. Tap **OK**.

   Note *– You can still enter new information as before, but these entries are not added to the data dictionary. To add items to the data dictionary, edit the .txt file on an office computer.*

CHAPTER 5

Connectivity settings

In this chapter:

GPS receiver settings **98**

GPS output settings **115**

Remote Output setup **118**

Serial Data Input **124**

Ag3000 modem **124**

DCM-300 Modem **125**

This chapter covers connectivity related to:

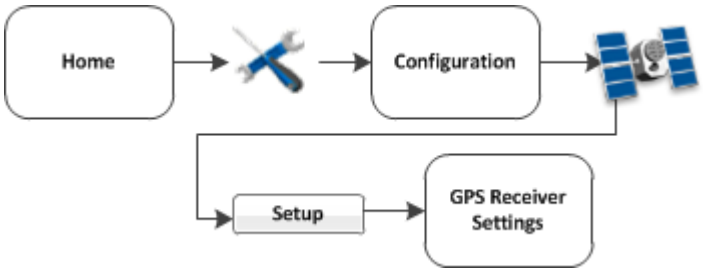
- GPS receiver settings, including corrections
- GPS output
- Serial data input
- Remote Output setup

GPS receiver settings

The FM-1000 integrated display automatically adds a GPS receiver option that controls the internal GPS receiver, when you install:

- Manual Guidance
- Autopilot
- FieldLevel II

In addition, the system may need second GPS receiver. For example, the TrueTracker system uses a second receiver that is configured with a separate GPS receiver option.



Note *– GPS receiver settings will show different options, depending on how your system is setup.*

Setup of the GPS receiver begins with corrections. The following corrections are available:

- Autonomous (no GPS corrections): WAAS and EGNOS
- CenterPoint™ RTK (see CenterPoint RTK (page 101))
- CenterPoint RTX™ (see CenterPoint RTX (fs) (page 103))
- CenterPoint RTX (sc) (page 105)
- CenterPoint RTX (ss) (page 106)
- OmniSTAR® wide-area differential GPS service (see OmniSTAR HP/XP/G2 (page 110))
- RangePoint RTX (page 113)
- SBAS: Tracks DGPS correction systems using WAAS

AgRemote Interface

Note *– Only advanced users should use the AgRemote interface.*

The FM-1000 integrated display has an on-screen AgRemote interface for manually adjusting GPS receiver settings.

To access the on-screen AgRemote interface:

1. At the *Configuration* screen, tap GPS Receiver and then tap **Diagnostics**. The *GPS Status* screen displays.
2. Tap **AgRemote**. The on-screen AgRemote interface displays.

For more information on the correct use of the AgRemote interface, refer to the *AgRemote Software Guide for AgGPS Receivers* on www.trimble.com.

Basic correction settings

For the basic corrections, complete the following steps.

1. At the *Configuration* screen, tap GPS Receiver, then tap **Setup**. The *GPS Receiver Settings* screen displays.
2. On the Settings tab, from the Corrections list select either:
   - Autonomous
   - SBAS
3. On the Advanced tab, enter the settings.

Setting	Explanation
Elevation Mask	
SNR Mask	
RTK Base Station Filter	Enabled, Disabled
RTK Base Station CMR ID	Can be edited if Filter is enabled
Scintillation Filter	On or Off

4. On the Logging tab, if you want to record logs, select Record Logs.
5. On the Radar Output tab, enter the settings.

Setting	Explanation
Connector	None or Connector D
Radar Frequency Rate	Enter Hz/mph rate

6. When you have completed the settings, tap **OK**.

CenterPoint RTK

Trimble CenterPoint™ RTK is radio-broadcast corrections from a ground-based reference station using either:

- Single-based line (CenterPoint RTK)
- Internet with a DCM-300 modem (CenterPoint VRS)

1. At the *Configuration* screen, tap GPS Receiver, then tap **Setup**. The *GPS Receiver Settings* screen displays.
2. On the Settings tab, complete the settings.

Setting	Explanation
Antenna Selection	Select a supported antenna type
Corrections	Choose CenterPoint RTK
Net ID	
GPS Output	Tap to open the *GPS Output Settings* screen to send messages. See GPS output settings (page 115).

3. On the xFill tab, enter the settings.

Setting	Explanation
x-Fill™ technology	On or Off During RTK signal interruptions, xFill technology can sustain RTK operation for up to 20 minutes.
Frequency	See Frequencies and baud rate (page 114).
Baud Rate	See Frequencies and baud rate (page 114).
Datum Selector	Choose the datum that was used when the RTK base station was surveyed. For more information contact your local reseller. ***Note*** *– You must select the correct base datum for your location. If you select an incorrect value, this will result in incorrect xFill operation.*

4. On the SecureRTK tab, enter the key or keys and an optional description.

   The base station access code provided by your base station service provider. After you enter this code, the Status and Expiry values change to show the current status of the security feature.

SecureRTK is a Trimble proprietary base station security feature that enables a service provider with a RTK base station to generate time-based access codes for their supported rovers. If SecureRTK is enabled on the base station, rovers with authorized access codes can use corrections from that base.

SecureRTK requires firmware version 1.59, or later, on MS750™ GPS receivers, and firmware version 4.60 or later on *Ag*RTK, *Ag*GPS 442, and *Ag* GPS 542 base stations.

Note *– Rovers without a SecureRTK access code are unable to access a secure Trimble RTK base station.*

5. On the Advanced tab, enter the settings.

Setting	Explanation
Elevation Mask	
SNR Mask	
RTK Base Station Filter	Enabled, Disabled
RTK Base Station CMR ID	Can be edited if Filter is enabled
Scintillation Filter	On or Off

6. On the Logging tab, if you want to record logs, select Record Logs.
7. On the Radar Output tab, enter the settings.

Setting	Explanation
Connector	Select Connector D to enable radar output. The display can convert GPS speed into an analog frequency that is identical to output from a radar speed sensor.
Radar Frequency Rate	Enter the required rate.

8. When you have completed the settings, tap **OK**.

CenterPoint RTX (fs)

CenterPoint RTX™ (fs - fast start) is a satellite-based subscription correction service.

1. At the *Configuration* screen, tap GPS Receiver, then tap **Setup**. The *GPS Receiver Settings* screen displays.
2. On the Settings tab, complete the settings.

Setting	Explanation
Antenna Selection	Select a supported antenna type
Corrections	Choose CenterPoint RTX (fs)
FastRestart	On or off FastRestart technology greatly reduces the time needed for OmniSTAR HP/XP/G2/VBS and CenterPoint RTX convergence. After the satellite signal has initially converged, you can turn off the receiver. When you turn the receiver on again, accuracy levels will be similar to those experienced before shutdown.
Convergence Threshold	Disabled
GPS Output	Tap to open the *GPS Output Settings* screen to send messages. See GPS output settings (page 115).

3. On the Frequencies tab, enter the settings for Frequency and Baud Rate. See Frequencies and baud rate (page 114).
4. On the Advanced tab, enter the settings.

Setting	Explanation
Elevation Mask	
SNR Mask	
RTK Base Station Filter	Enabled, Disabled
RTK Base Station CMR ID	Can be edited if Filter is enabled
Scintillation Filter	On or Off

5. On the Logging tab, enter the settings.

Setting	Explanation
Record AgRemote Logs	Off or Record Logs

6. On the Radar Output tab, enter the settings.

Setting	Explanation
Connector	Select Connector D to enable radar output. The display can convert GPS speed into an analog frequency that is identical to output from a radar speed sensor.
Radar Frequency Rate	Enter the required rate.

7. When you have completed the settings, tap **OK**.

CenterPoint RTX (sc)

CenterPoint RTX (sc - standard cell) is a satellite-based subscription correction service.

1. At the *Configuration* screen, tap GPS Receiver, then tap **Setup**. The *GPS Receiver Settings* screen displays.
2. On the Settings tab, complete the settings.

Setting	Explanation
Antenna Selection	Select a supported antenna type
Corrections	Choose CenterPoint RTX (ss)
FastRestart	On or off FastRestart technology greatly reduces the time needed for OmniSTAR HP/XP/G2/VBS and CenterPoint RTX convergence. After the satellite signal has initially converged, you can turn off the receiver. When you turn the receiver on again, accuracy levels will be similar to those experienced before shutdown.
Convergence Threshold	Disabled
GPS Output	Tap to open the *GPS Output Settings* screen to send messages. See GPS output settings (page 115).

3. On the Logging tab, if you want to record logs, select Record Logs.
4. On the Radar Output tab, enter the settings.

Setting	Explanation
Connector	Select Connector D to enable radar output. The display can convert GPS speed into an analog frequency that is identical to output from a radar speed sensor.
Radar Frequency Rate	Enter the required rate.

5. When you have completed the settings, tap **OK**.

CenterPoint RTX (ss)

CenterPoint RTX (ss - standard satellite) is a satellite-based subscription correction service.

1. At the *Configuration* screen, tap GPS Receiver, then tap **Setup**. The *GPS Receiver Settings* screen displays.
2. On the Settings tab, complete the settings.

Setting	Explanation
Antenna Selection	Select a supported antenna type
Corrections	Choose CenterPoint RTX (ss)
FastRestart	On or off FastRestart technology greatly reduces the time needed for OmniSTAR HP/XP/G2/VBS and CenterPoint RTX convergence. After the satellite signal has initially converged, you can turn off the receiver. When you turn the receiver on again, accuracy levels will be similar to those experienced before shutdown. ***Note*** *– Do not move the vehicle from the point of system shut down. Otherwise this feature will not work.*
Convergence Threshold	Disabled
GPS Output	Tap to open the *GPS Output Settings* screen to send messages. See GPS output settings (page 115).

3. On the Frequencies tab, enter the settings for Frequency and Baud Rate. See Frequencies and baud rate (page 114).
4. On the Advanced tab, enter the settings.

Setting	Explanation
Elevation Mask	
SNR Mask	
RTK Base Station Filter	Enabled, Disabled
RTK Base Station CMR ID	Can be edited if Filter is enabled
Scintillation Filter	On or Off

5. On the Logging tab, if you want to record logs, select Record Logs.

6. On the Radar Output tab, enter the settings.

Setting	Explanation
Connector	Select Connector D to enable radar output. The display can convert GPS speed into an analog frequency that is identical to output from a radar speed sensor.
Radar Frequency Rate	Enter the required rate.

7. When you have completed the settings, tap **OK**.

OmniSTAR HP/XP/G2 - VBS

OmniSTAR VBS is a satellite-based subscription correction service delivered either by:

- Satellite
- Internet using a DCM-300 modem with <1.5" (3.8 cm) accuracy and GLONASS compatibility

1. At the *Configuration* screen, tap GPS Receiver, then tap **Setup**. The *GPS Receiver Settings* screen displays.
2. On the Settings tab, complete the settings.

Setting	Explanation
Antenna Selection	Select a supported antenna type
Corrections	Choose OmniSTAR HP/XP/G2 - VBS
FastRestart	On or off FastRestart technology greatly reduces the time needed for convergence. After the satellite signal has initially converged, you can turn off the receiver. When you turn the receiver on again, accuracy levels will be similar to those experienced before shutdown. ***Note*** *– Do not move the vehicle from the point of system shut down. Otherwise this feature will not work.*
Convergence Threshold	Disabled
GPS Output	Tap to open the *GPS Output Settings* screen to send messages. See GPS output settings (page 115).

3. On the Advanced tab, enter the settings.

Setting	Explanation
Elevation Mask	
SNR Mask	

4. On the Logging tab, if you want to record logs, select Record Logs.

5. On the Radar Output tab, enter the settings.

Setting	Explanation
Connector	Select Connector D to enable radar output. The display can convert GPS speed into an analog frequency that is identical to output from a radar speed sensor.
Radar Frequency Rate	Enter the required rate.

6. When you have completed the settings, tap **OK**.

OmniSTAR HP/XP/G2

OmniSTAR HP/XP/G2 is a high-accuracy, satellite-based subscription correction service. The accuracy for each type is:

- HP: 2-4" (5-10 cm) accuracy
- XP: 3-4" (8-10 cm) accuracy
- GP: 2-4" (8-10 cm) accuracy (compatible with GLONASS)

1. At the *Configuration* screen, tap GPS Receiver, then tap **Setup**. The *GPS Receiver Settings* screen displays.
2. On the Settings tab, complete the settings.

Setting	Explanation
Antenna Selection	Select a supported antenna type
Corrections	Choose OmniSTAR HP/XP/G2
FastRestart	On or off FastRestart technology greatly reduces the time needed for convergence. After the satellite signal has initially converged, you can turn off the receiver. When you turn the receiver on again, accuracy levels will be similar to those experienced before shutdown.
Convergence Threshold	The required accuracy of the correction service before the signal will converge and the automatic steering system will engage.
GPS Output	Tap to open the *GPS Output Settings* screen to send messages. See GPS output settings (page 115).

3. On the Advanced tab, enter the settings.

Setting	Explanation
Elevation Mask	
SNR Mask	

4. On the Logging tab, if you want to record logs, select Record Logs.

5. On the Radar Output tab, enter the settings.

Setting	Explanation
Connector	Select Connector D to enable radar output. The display can convert GPS speed into an analog frequency that is identical to output from a radar speed sensor.
Radar Frequency Rate	Enter the required rate.

6. When you have completed the settings, tap **OK**.

OmniSTAR VBS

OmniSTAR VBS is a satellite-based subscription correction service with 6-8" (15-20 cm) accuracy.

1. At the *Configuration* screen, tap GPS Receiver, then tap **Setup**. The *GPS Receiver Settings* screen displays.
2. On the Settings tab, complete the settings.

Setting	Explanation
Antenna Selection	Select a supported antenna type
Corrections	Choose OmniSTAR VBS
GPS Output	Tap to open the *GPS Output Settings* screen to send messages. See GPS output settings (page 115).

3. On the Advanced tab, enter the settings.

Setting	Explanation
Elevation Mask	
SNR Mask	

4. On the Logging tab, if you want to record logs, select Record Logs.
5. On the Radar Output tab, enter the settings.

Setting	Explanation
Connector	Select Connector D to enable radar output. The display can convert GPS speed into an analog frequency that is identical to output from a radar speed sensor.
Radar Frequency Rate	Enter the required rate.

6. When you have completed the settings, tap **OK**.

RangePoint RTX

Trimble RangePoint™ RTX is a satellite-based subscription correction service with pass-to-pass <6" (15 cm) accuracy and GLONASS compatibility.

1. At the *Configuration* screen, tap GPS Receiver, then tap **Setup**. The *GPS Receiver Settings* screen displays.
2. On the Settings tab, complete the settings.

Setting	Explanation
Antenna Selection	Select a supported antenna type
Corrections	Choose RangePoint RTX
GPS Output	Tap to open the *GPS Output Settings* screen to send messages. See GPS output settings (page 115).

3. On the Frequencies tab, enter the settings for Frequency and Baud Rate. See Frequencies and baud rate (page 114).
4. On the Logging tab, if you want to record logs, select Record Logs.
5. On the Radar Output tab, enter the settings.

Setting	Explanation
Connector	Select Connector D to enable radar output. The display can convert GPS speed into an analog frequency that is identical to output from a radar speed sensor.
Radar Frequency Rate	Enter the required rate.

6. When you have completed the settings, tap **OK**.

Frequencies and baud rate

When you receive satellite signals, you must select the frequency and baud rate based on your specific region.

Region	Baud Rate
Western North America (RTX WN)	1557.8615 MHz at 600 baud
Central North America (RTX CN)	1557.8150 MHz at 2400 baud
Eastern North America (RTX EN)	1557.8590 MHz at 600 baud
South/Central America (RTX SA)	1539.8325 MHz at 600 baud
Europe/Africa (RTX EA)	1539.9525 MHz at 600 baud
Asia Pacific (RTX AP)	1539.8325 MHz at 600 baud

***Note** – These frequencies do change occasionally. If you experience issues with the satellite signal, contact your reseller for updated satellite information.*

GPS output settings

To access the *GPS Output Settings* screen:

1. At the *Configuration* screen, tap GPS Receiver, then tap **Setup**. The *GPS Receiver Settings* screen displays.
2. On the Settings tab, tap **GPS Output**. The *GPS Output Settings* screen displays. There are three tabs available:
   - Serial NMEA messages, 1
   - Serial NMEA messages (page 115)
   - CAN GPS messages, 1

Serial NMEA messages

Note *– Depending on your configuration, NMEA message output may require: Part number 67091, FmX to DE9, RS232 cable (Port A or B), Part number 59043, DB9(F) to DB9(F) modem cable.*

Some GPS receivers can output serial NMEA messages to an external device. For example, if you have an external device connected to the Autopilot controller, you can have the receiver send GPS position information to the device. The messages are output through the NavController harness laptop connector.

Note *– To enable NMEA output from another receiver for an optional feature, make sure the feature has been selected from the feature list.*

At the Serial NMEA Messages tab on the *GPS Output Settings* screen, complete the settings and tap **OK**.

Setting	Explanation
Message Rate	How often the message is sent. Options are: • Off • 1 min • 30 sec • 10 sec • 1 Hz • 3 Hz • 5 Hz • 10 Hz
Output Port	What port the message should be sent from. Options are:

Setting	Explanation
	• A (ext GPS) • B (ext GPS) • C (int GPS) • D (int GPS) • Autopilot
Baud Rate	Baud rate. Options are: • 2400 • 4800 • 9600 • 19200 • 38400 • 57600
Maximum CGA Quality	How high the quality of the message should be
Lat/Lon Precision	Options are 1 through 10

NMEA messages

Some GPS receivers can output NMEA GGA type messages to an external device. For example, if you have an external device connected to the Autopilot controller, you can have the receiver send GPS position information to the device. The messages are output through the NavController harness laptop connector.

Note *– To enable NMEA output from another receiver for an optional feature (for example, the GPS receiver connected to an TrueTracker system controller), make sure the feature has been selected from the feature list.*

At the NMEA tab on the *GPS Output Settings* screen, complete the settings and tap **OK**.

Setting	Explanation
Message Rate	How often you want the message sent
Baud Rate	Baud rate
Messages Enabled	On: Send NMEA message. Off: Do not send NMEA message. Message types supported are: • CGA • VTG

Setting	Explanation
	• GSA • GST • RMC • ZDA

CAN GPS messages

You can set up specific messages to be sent from the GPS receiver from a CAN port. If you are using an ISO-certified implement, use this setting to send information to the implement (such as speed).

At the CAN GPS tab on the *GPS Output Settings* screen, complete the settings and tap **OK**.

Section	Setting	Explanation
Output	Port	The port you want the GPS speed to be sent from
	Rate	How often you want the message to be sent
Simulated Speeds	Wheel Speed Port	The port you want the wheel speed to be sent from
	Wheel Speed Rate	Off or On
	Radar/Ground Speed Port	The port you want the radar/ground speed to be sent from
	Radar/Ground Speed Rate	Off or On

Remote Output setup

When remote output is activated, the FM-1000 integrated display sends pulses to an external device. For example, you can use a remote output signal to control a tree planter.

To set up Remote Output:

1. Install Remote Output. See Activate features/plugins for use (page 45).
2. Set up Remote Output. See Remote Output settings (page 118).
3. Calibrate the lead time. See Calibrate implement lead time (page 121).

Remote Output settings

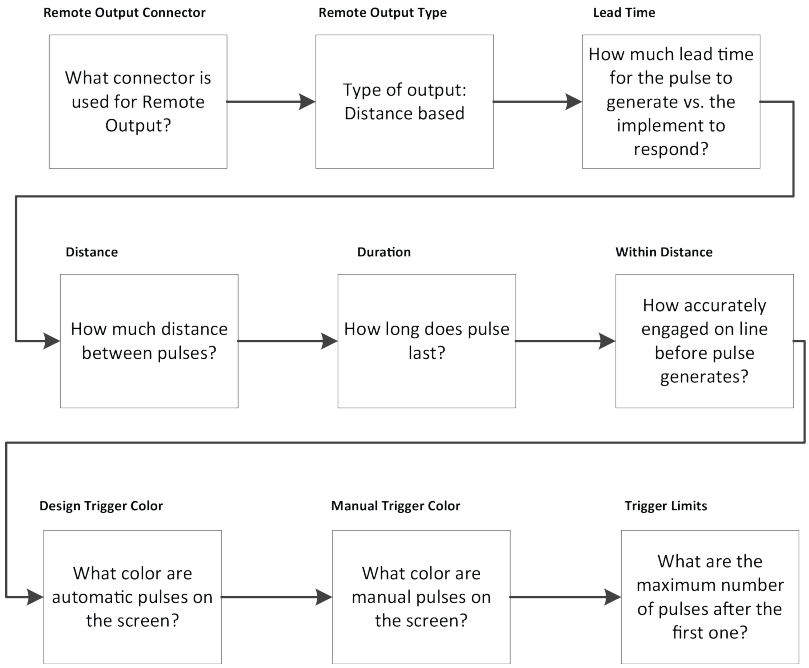
To enable pulse remote output:

1. At the *Configuration* screen, select Remote Output and then tap **Setup**.
2. The *Remote Output* screen displays. Complete the settings and tap **OK**.
3. For Remote Output Connector:

   Select Connector B.
4. For Remote Output Type, choose the type:
   a. For Time Based Pulse, enter:

Setting	Explanation
Time	The pulse interval in seconds
Duration	The pulse duration in milliseconds

   b. For Distance Based Pulse, enter:


Remote Output Connector
What connector is used for Remote Output?
Remote Output Type
Type of output: Distance based
Lead Time
How much lead time for the pulse to generate vs. the implement to respond?
Distance
How much distance between pulses?
Duration
How long does pulse last?
Within Distance
How accurately engaged on line before pulse generates?
Design Trigger Color
What color are automatic pulses on the screen?
Manual Trigger Color
What color are manual pulses on the screen?
Trigger Limits
What are the maximum number of pulses after the first one?

Setting	Explanation
Lead Time	See Calibrate implement lead time (page 121).
Distance	The distance in meters/decimal feet/feet and inches. The pulse occurs at each increment of this distance. The first pulse occurs at the A point. Pulse remote output is not recommended for Headland patterns.
Duration	The duration of the pulse in milliseconds (ms)
Within Line Distance	The pulse occurs only when the vehicle is within this distance of being online. If the vehicle is more than this distance offline, no pulse occurs
Design Trigger Color	The color of the pulse indicator that will display on the screen when the system automatically outputs a pulse
Manual Trigger Color	The color of the pulse indicator that will display on the screen when you press the manual trigger button
Trigger Limits	If you select None, the pulses triggered by the system are unlimited. If you select Edit, enter the maximum number of pulses (per swath) that will be triggered after you pass the A point.

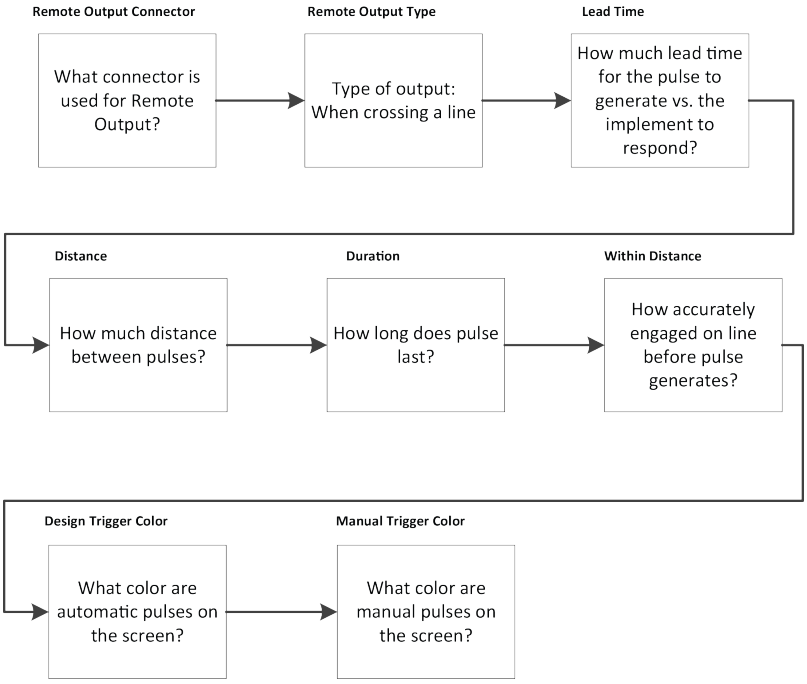
Note *– This option works with straight AB and A+ lines.*

For using remote output using distance based pulses, see Distance-based pulse operation (page 375).

c. For When Within Area Feature, enter the Lead Time. Calibrate the Lead Time setting to match your implement. See Calibrate implement lead time (page 121). The pulse occurs only when Remote Output is enabled. You must also enable Remote Output for each area feature individually in the Mapping setup. See Field feature use (page 322).

d. For When Engaged, there are no options to set. Remote output occurs when the system is engaged.

e. For When Crossing a Line Feature, enter:


Remote Output Connector
What connector is used for Remote Output?
Remote Output Type
Type of output: When crossing a line
Lead Time
How much lead time for the pulse to generate vs. the implement to respond?
Distance
How much distance between pulses?
Duration
How long does pulse last?
Within Distance
How accurately engaged on line before pulse generates?
Design Trigger Color
What color are automatic pulses on the screen?
Manual Trigger Color
What color are manual pulses on the screen?

Setting	Explanation
Lead Time	See Calibrate implement lead time (page 121).
Distance	The distance in meters/decimal feet/feet and inches. The pulse occurs at each increment of this distance. The first pulse occurs at the A point. ***Note*** *– Pulse remote output is not recommended for Headland patterns.*
Duration	The duration of the pulse in milliseconds (ms)

Setting	Explanation
Within Line Distance	The pulse occurs only when the vehicle is within this distance of being online. If the vehicle is more than this distance offline, no pulse occurs
Design Trigger Color	The color of the pulse indicator that will display on the screen when the system automatically outputs a pulse
Manual Trigger Color	The color of the pulse indicator that will display on the screen when you press the manual trigger button

Be sure to edit the line feature to enable remote output and the trigger warning. See Line feature settings (page 134). Complete the settings and tap **OK**.

Note *– This option works with straight AB and A+ lines, pivots and curves.*

For using remote output using when crossing a line feature, see Crossing a line feature operation (page 377).

5. Tap **OK** when your are finished.

Calibrate implement lead time

There is usually a gap between the time when the system generates a pulse and the time when that pulse triggers an action on the implement. To compensate for this system delay, you can set a lead time to trigger the pulse slightly early so that the action occurs at the correct location.

For this calibration, drive the vehicle along a line and back, using Remote Output to mark points on the ground. If the remote output is correctly calibrated, the points that you create when driving in both directions will be close together.

To calibrate implement lead time:

1. Set front/back offset (page 121).
2. Calibrate front/back offset (page 122).
3. Set lead time (page 122).

Set front/back offset

Configure the correct front/back offset.

1. Accurately measure either of these as appropriate:
   - Autopilot systems: The distance between the fixed axle of the vehicle and the part of the implement where the trigger marks will be applied on the ground.
   - Manual guidance systems: The distance between the antenna center-point and the part of the implement where the trigger marks will be applied on the ground.

2. At the *Configuration* screen, tap Implement Setup.
3. Enter the measurement as the F/B Offset distance on the *Implement Boom Setup* screen.

Calibrate front/back offset

1. Create a straight AB Line.
2. At the *Remote Output* screen, set the Lead Time to 0.
3. Drive as slowly as possible down the AB Line from point A to point B, marking points on the ground where the remote output triggers.
4. At the end of the line, turn the vehicle around.
5. Drive back down the line from point B to point A, marking another set of trigger points.
6. Measure the distance between the points from the first run and the points from the second run.
7. Divide the distance by two.
8. Adjust your Front/Back Offset value by this amount.
9. If the return points are nearer where you originally started than the first set of points, increase the F/B offset.
10. If the return points are further from where you originally started than the first set of points, lower the F/B offset.

Set lead time

1. Drive at your intended application speed down the AB Line from point A to point B, marking points on the ground where the remote output triggers. Ensure that your speed remains constant.
2. At the end of the line, turn the vehicle around.
3. Drive back down the line from point B to point A, marking the trigger points.
4. Measure any offset distance between the points from the first run and the points from the second run.
5. Divide the distance by two.
6. Convert your speed from mph to inches/second.

   Inches/second = mph x 17.6.
7. To calculate the lead time setting (in seconds), divide the distance between the points (in inches) from Step 5 by the vehicle speed (in inches/second).

   Lead Time = Half the distance between points (inches) divided by speed (inches per second)
8. Enter the lead time at the *Remote Output* screen.

   For example, if a 4 mph pass creates a 14" distance between each set of points:

- Divide the distance between the points by 2. (In this example, 14" / 2 = 7")
- Convert the speed from mph to inches/second. (4 mph = (4 x 17.6) = 70.4 inches/second)
- Divide the halved distance between the points by the speeds
  7" divided by 70.4" per second = 0.999 Lead time in seconds

9. Drive along the AB line and then back at your application speed while you create trigger points.
10. Ensure that the trigger points are sufficiently close to one another.
11. If the gap between the points is unacceptable, repeat the calibrations.

Serial Data Input

Serial Data Input is an optional feature/plugin. When it is activated, the FM-1000 integrated display can receive and log NMEA messages from an external device (for example, an infra-red sensor).

1. Install Serial Data Input. See Activate features/plugins for use (page 45).
2. At the *Configuration* screen, select Serial Data Input and tap **Setup**. The *Serial Data Input* screen displays.
3. Complete the settings and tap **OK**.

Setting	Explanation
Port	The port the device is connected to. This is usually P5 Serial I/O. The settings for the port display on the right of the screen.
Baud rate	
Parity	
Data bits	
Stop bits	
Prefix	The start point of the data you want to collect. • To log data from the start of the line, leave this field empty. • To drop introductory characters, enter them. For example, if you receive data that begins with "$GPGGA...", enter "\24GP" in this field. The data will then begin with "GGA...". ("\24" is the ASCII code for "$".)
Suffix	The end point of the data you want to collect. To log to the end of the line, keep the default field ("\0D\0A").
Log Interval	How regularly the data is written to the file.

Ag3000 modem

The Ag3000 modem enables the FM-1000 integrated display to receive RTK corrections from a:

- Trimble VRS network
- Third-party RTK provider
- Continuously Operating Reference Station (CORS)

Modem activation

In the USA, the Ag3000 is bundled with a Trimble-installed AT&T card, which is tied to your Ag3000 unit and cannot be separated. You cannot use any other SIM cards with this device.

Additionally, the Ag3000 modem does not work in a CDMA network.

Outside of the USA, you must contact your local VRS Now™ or third-party cell provider for a SIM card.

Modem setup

Activate VRS for use. See Activate features/plugins for use (page 45).

1. At the *Configuration* screen, select VRS and then tap **Setup**.
2. The *VRS Configuration* screen displays.
3. Select the VRS Server Setup tab. Enter the required settings, as provided by your Trimble VRS Now™ or Network RTK operator.

Setting	Explanation
Server Name/Address	RTK/VRS/CORS base station broadcast name
Server Port Number	Base station port number
Mount Point	Base station mount point
User Name	Assigned username
Password	Assigned password

4. If you are inside the USA, tap **OK**. The *Configuration* screen displays. The Ag3000 modem is now configured.
5. If you are outside the USA, select the SIM Card Setup tab. Enter the details of the SIM card from the card provider, then tap **OK**.

DCM-300 Modem

The DCM-300 modem is a rugged and sealed 3G communications solution for customers who need reliable communications for their farming operations. This modem enables the FM-1000 integrated display to receive RTK corrections from a:

- Trimble VRS network
- Third-party RTK provider
- Continuously Operating Reference Station (CORS)

The benefits of using the DCM-300 modem include:

- More acres of RTK accuracy from Trimble VRS Now delivered to the display.
- Easy interface and configuration with the display.
- Roof-mounted high-gain cellular antenna for enhanced signal reception to minimize cell phone signal related drop outs.
- On-screen wireless status and diagnostics.
- Vehicle Sync
- Office Sync

The DCM-300 modem is available:

- With a HSDPA modem for use with GSM wireless networks globally
- An EVDO modem for use with the Verizon wireless network in the USA

Unlock the modem

The DCM-300 modem is available at different prices for Asset Tracking and VRS/File Transfer. The VRS/File Transfer functionality in the DCM-300 modem must be unlocked to use VRS or data transfer.

To unlock the DCM-300 with a passcode, you must connect the modem to the display and then turn it on. The *Unlock* screen shows the DCM-300 when connected.

Enter the passcode in the FM-1000 integrated display and then tap **OK** to send it to the modem. When the modem is successfully unlocked, a message displays to reboot the modem.

Service activation

Services for the DCM-300 modem can be purchased from a Trimble store. Services include:

- VRS Now Ag correction service
- Sync data transfer
- Dispatch asset tracking
- Wireless data plans (USA only)

Modem setup

Activate VRS for use. See Activate features/plugins for use (page 45).

To use VRS corrections, the GPS Setup tab must be configured with a Correction type of Trimble VRS.

Note *– The display must be unlocked for RTK to use the Trimble VRS correction type.*

1. At the *Configuration* screen, select VRS and then tap **Setup**. The *VRS Configuration* screen displays.
2. From the Device list, select the type of modem that is connected. The default is DCM-300.
3. Select the VRS Server Setup tab. Enter the required settings, as provided by your Trimble VRS Now or Network RTK operator.

Setting	Explanation
Server Name/Address	RTK/VRS/CORS base station broadcast name
Server Port Number	Base station port number
Mount Point	Base station mount point
User Name	Assigned username
Password	Assigned password

4. If you are inside the USA and:

   Subscribe to the AT&T or Verizon data plans and have a DCM-300G modem, tap **OK**. The *Configuration* screen displays.

   Supply your own SIM card and have a DCM-300G modem, enter the details of the SIM card from the card provider, then tap **OK**.

Note *– The DCM-300C modem for Verizon does not use the SIM card setup tab.*

CHAPTER 6

Field feature mapping setup

In this chapter:

Field feature mapping settings **130**
Mapping location setting **132**
Recording with coverage **132**
Field area feature settings **133**
Line feature settings **134**
Boundary feature settings **134**
Point feature settings **136**

You can place features on the screen that represent points, areas and lines in your field.

Field feature mapping settings

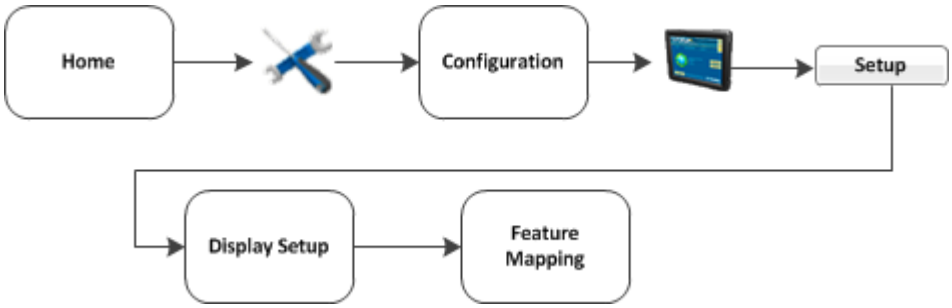
You can place field features in the field while driving to define on the screen points of interest or areas to avoid. There are three types of field feature:

- Point: A single point in the field, such as a tree
- Line: A straight or curved line in a field, such as a fence
- Area: An area of land, such as a pond

You can customize:

- Which features display on the Mapping Guidance panel at the *Run* screen
- The settings of each feature

Access Feature Mapping settings



1. At the *Home* screen tap . The *Configuration* screen displays.
2. Select System and tap **Setup**. The *Display Setup* screen displays.
3. Select Feature Mapping and tap **Setup**. The *Feature Mapping* screen displays.

Assign feature buttons

To assign the feature buttons that will be available on the Mapping Guidance panel in the *Run* screenn:

1. At the *Feature Mapping* screen, tap one of the four buttons under the Selected Features section. The *Select Feature* screen displays.
2. At the top left-hand list, choose the type of feature: Area, Line or Point. The options available to you for that feature type are listed below.
3. Select the feature option you want and tap **OK**.

Create a field feature

To create a feature in your field:

1. At the *Feature Mapping* screen, tap one of the four buttons under the Selected Features section. The *Select Feature* screen displays.
2. At the top left-hand list, choose the type of feature: Area, Line or Point.
3. Tap **New**. The *Edit Area/Line/Point Feature* screen displays.
4. Tap in the entry box for the name of the feature. The *Enter Area/Line/Point Feature Name* screen displays.
5. Enter the name of the feature and tap **OK**. You are returned to the *Edit Area/Line/Point Feature* screen.
6. Complete the settings for the feature you have added. For specifics, see:
   - Field area feature settings (page 133)
   - Line feature settings (page 134)
   - Point feature settings (page 136)
7. Tap **OK**. The *Feature Mapping* screen displays again, showing the button of the feature you just created.

Edit a field feature

To edit a feature you have placed in your on-screen field:

1. At the *Feature Mapping* screen, tap one of the four buttons under the Selected Features section. The *Select Feature* screen displays.
2. At the top left-hand list, choose the type of feature: Area, Line or Point.
3. Tap **Edit**. The *Edit Area/Line/Point Feature* screen displays.
4. To edit the name:
   a. Tap in the entry box for the name of the feature. The *Enter Area/Line/Point Feature Name* screen displays.
   b. Enter the name of the feature and tap **OK**. You are returned to the *Edit Area/Line/Point Feature* screen.
5. Edit the settings for the feature you have added. For specifics, see:
   - Field area feature settings (page 133)
   - Line feature settings (page 134)
   - Point feature settings (page 136)

6. Tap **OK**. The *Feature Mapping* screen displays again, showing the button of the feature you just edited.

Mapping location setting

As you place features in your on-screen field, they are placed in relation to the:

- Center of the boom
- Right of the boom
- Left of the boom

Access these settings at the *Feature Mapping* screen.

1. At the *Home* screen tap . The *Configuration* screen displays.
2. Select System and tap **Setup**. The *Display Setup* screen displays.
3. Select Feature Mapping and tap **Setup**. The *Feature Mapping* screen displays.
4. Complete the settings for the Mapping Location section and tap **OK**.

Setting	Explanation
Point Features	Point features should be placed in your on-screen field relation to: • Boom Center: The center of the boom • Boom Right: To the right of the boom • Boom Left: To the left of the boom
Line/Area Features	Line and area features should be placed in your on-screen field relation to: • Boom Center: The center of the boom • Boom Right: To the right of the boom • Boom Left: To the left of the boom

Recording with coverage

You can choose to have line features be recorded when you have enabled coverage.

1. At the *Home* screen tap . The *Configuration* screen displays.
2. Select System and tap **Setup**. The *Display Setup* screen displays.
3. Select Feature Mapping and tap **Setup**. The *Feature Mapping* screen displays.
4. From the Record Line with Coverage list, choose:
   - None: The line will not automatically record when you begin logging coverage.
   - As Applied:
   - Fence:
5. Tap **OK**.

Field area feature settings

You can use area features to define areas of land as productive or unproductive. If the sprayer passes into an area that is defined as unproductive, the boom sections turns off. This can be useful for setting exclusion zones that you do not want to spray (such as waterways).

Setting	Explanation
Name	Name of the feature
Color	Select the feature appearance color
Area Type	Productive: Choose this option if the area feature will be a section of land that can be included in area calculations. Non-productive: Chose this option if the area is unproductive land.
Trigger Warning	No Warning: No warning displays. Entering Area: A warning displays while you are inside the area. Leaving Area: A warning displays while you are outside the area.
Remote Output	Set to Enabled if a signal pin is attached to the system. This enables you to trigger a pulse to an external device when you enter or exit this area. See Remote Output setup (page 118) and Remote Output operation (page 375).
Expand by	Options are: • 1/2 swath width • 1 swath width

Line feature settings

1. At the *Feature Mapping* screen, tap one of the four buttons under the Selected Features section. The *Select Feature* screen displays.
2. At the top left-hand list, choose the Line feature.
3. Tap **New**. The *Edit Area/Line/Point Feature* screen displays.
4. Tap in the entry box for the name of the feature. The *Enter Area/Line/Point Feature Name* screen displays.
5. Enter the name of the line and tap **OK**. You are returned to the *Edit Area/Line/Point Feature* screen.
6. Complete the settings for the line:

Setting	Explanation
Color	Select the feature appearance color
Trigger Warning	Enabled: Warning is enabled Disabled: No warning will be issued
Remote Output	Set to Enabled if a signal pin is attached to the system. This enables you to trigger a pulse to an external device when you enter or exit this area. See Remote Output setup (page 118) and Remote Output operation (page 375).

7. Tap **OK**. The *Feature Mapping* screen displays again, showing the button of the feature you just created.

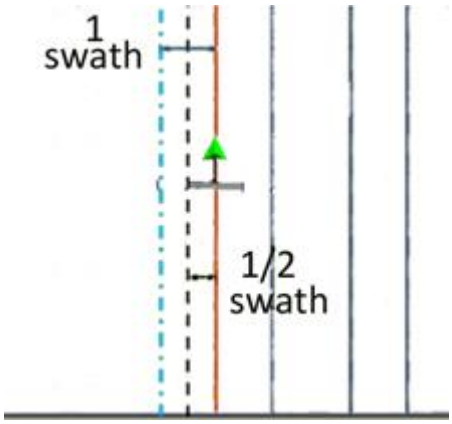
Boundary feature settings

The FM-1000 integrated display includes the field boundary feature that enables you to map multiple-bounded areas within a field.

Field boundaries create a separate boundary file that can be used to calculate area and control automatic section switching at the edge of the field.

1. At the *Feature Mapping* screen, tap one of the *Selected Features* buttons. The *Select Feature* screen displays.
2. From the feature list, select Area and then tap **New**.
3. From the list of features, select Boundary and then tap **Edit**. The *Edit Area Feature* screen displays.

4. Set one or more of the following the attributes for the boundary features.

Setting	Explanation
Name	Custom name that displays on the Feature Mapping tab.
Color	Color of the boundary outline and also the infill color, if selected.
Draw as	Outlined or Filled
Trigger Warning	Visual and audible warning when entering or leaving the boundary edge.
Remote Output	Enabled: Restricts remote output pulses from being triggered while outside the boundary. Disabled: Does not restrict remote output. See Remote Output setup (page 118).
Expand By	How the boundary is actually recorded: • Nothing: Maps the boundary exactly at the recorded position. • ½ Swath Width: Expands the recorded boundary location by ½ the swath width after the boundary is closed. • 1 Swath Width: Expands the recorded boundary location by 1 additional swath width after the boundary is closed. 

5. Tap **OK**. The *Select Feature* screen displays.
6. Tap **OK**. The *Feature Mapping* screen displays.
7. Tap **OK**. The *Display Setup* screen displays.
8. Tap **OK**.

Point feature settings

1. At the *Feature Mapping* screen, tap one of the four buttons under the Selected Features section. The *Select Feature* screen displays.
2. At the top left-hand list, choose the Point feature.
3. Tap **New**. The *Edit Area/Line/Point Feature* screen displays.
4. Tap in the entry box for the name of the feature. The *Enter Area/Line/Point Feature Name* screen displays.
5. Enter the name of the line and tap **OK**. You are returned to the *Edit Area/Line/Point Feature* screen.
6. Complete the settings for the point:

Setting	Explanation
Alarm Radius	• Displays as a solid red block when the vehicle comes within this radius of the feature • More serious than the warning radius. Set it to a shorter distance.
Warning Radius	• Distance around the feature that causes a warning message to appear • Displays on the screen as an orange line
Average Position	Improves the quality of the point feature position • Yes: The display calculates the average position of the feature over 30 seconds. • No: The display places the feature at the coordinates that the vehicle is at when you tap the button.

CHAPTER 7

Implement setup

In this chapter:

Implement setup **138**
Create an implement **139**
Select an implement **139**
Import an implement **140**
Edit implement settings **140**
Delete an implement **142**

Before you can begin operations, you must select an implement that has been created and set up in the system.

Implement setup

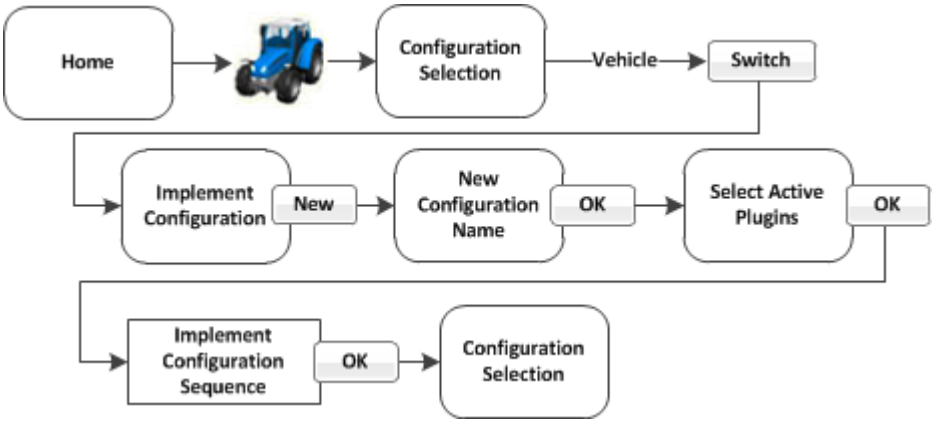
Settings for an implement vary depending on the implement type and the operation it will be performing.

Implement setup ensures the system can tell:

- Which type of implement is attached
- How much area it covers
- How far offset the implement is from the guidance line or pattern

Note *– Some configuration settings are unavailable when a field is open in the Run screen. To access these settings, return to the Run screen and then tap the Home button. When prompted to close the field, tap* **Close***.*

Create an implement



1. At the *Home* screen, tap .
2. At the *Configuration Selection* screen, tap **Switch** next to the implement.
3. If necessary, enter the administrative password. See Passwords (page 36).
4. At the *Implement Configuration* screen, tap **New**.
5. The *New Configuration Name* screen displays with an on-screen keyboard.
6. Enter a name for the new implement and tap **OK**. The *Select Active Plugins* screen displays.
7. Select the optional features/plugins that will be used with this implement and then tap **OK**.
8. The *Implement Setup* wizard displays. See Edit implement settings (page 140) to complete the settings.

   Note *– The information needed for implement setup depends on the plugins that you selected in the previous step.*
9. Tap **OK**. Your current configuration now displays in the *Configuration* screen.

Select an implement

To select an implement that has been configured:

1. At the *Home* screen, tap .
2. At the *Configuration Selection* screen, tap **Switch** next to the implement.
3. If necessary, enter the administrative password. See Passwords (page 36).

1. At the *Implement Configuration* screen, select the implement you want to switch to and then tap **OK**.

   Note *– If there is only one available implement, it is selected by default.*

2. The currently selected implement is displayed in the *Configuration Selection* screen.

Import an implement

To import an implement:

1. Copy the implement file into the AgGPS folder on the USB drive.
2. Insert the USB drive into the FM-1000 integrated display and then turn on the display.
3. At the *Home* screen, tap .
4. At the *Current Configurations* screen, tap **Setup**.
5. If necessary, enter the Administration password. See Passwords (page 36).
6. At the *Configuration* screen, select System and then tap **Setup**.
7. Select Data Files and then tap **Manage**.
8. Select Implement from the list on the left of the screen and then tap **Copy**.

The implements from the *FieldManager* screen now display in the *Implement Configuration* screen.

Edit implement settings

At the *Implement Setup* screen, you can change:

- Implement Type: Primary task for the current implement
- Measurements: Basic information required for guidance using an automatic steering system
- Geometry: More detailed implement dimensions required both with and without a GPS receiver on the implement
- Overlap: Values required to apply or avoid overlap
- Switches: Settings for switches tied to implement control system

Implement Type

In the Implement Type tab, choose the type of implement you want to set up.

Measurements

Note *– The screen is scaled to the swath or application width, whichever is larger. If any offset is greater than this, the tractor image may pass the edge of the screen.*

Note *– This setting is used for navigation. At the Run screen, when you tap* **Skip** *to adjust the guidance line, the guidance line moves to the current location of the vehicle or can be moved by a user entered distance or number of rows. Row width is defined by the swath width divided by the number of rows.*

Measurement	Explanation
Swath Width	Set the distance between guidance passes.
Application Width	The applied width of the tool or boom, which sets the width of the coverage logging and mapping.
Application Offset	Measured from the fixed axle of the vehicle to the point on the implement where coverage logging will be mapped. The fixed axle varies depending on vehicle type: • Rear axle on front steering tractor and self-propelled sprayer. • Front axle on a harvester and 4x4 tractor • Center of tracks on a tracked tractor
Rows	Number of rows that are covered by the implement.
Left/Right Offset	Measure from the center of the vehicle to the center of the implement or header. This measurement adjusts the tractor path so that an offset implement is centered on the guidance line.

Geometry

Set up the measurements required for accurate implement modeling.

Measurement	Explanation
Type	Select the implement type. The antenna offsets are required when a GPS antenna is mounted on the implement for TrueGuide and TrueTracker.
Hitch to Ground Contact Point	Measured from the tractor hitch pin to the soil engagement point that the implement rotates about. For planters this is typically the seeding units or the midpoint of several rows of tools

Note *– For modeled implements, shortening this setting causes the implement to come online more quickly while lengthening the setting causes the implement to come online more slowly.*

Overlap

When you map a headland, you create an inner boundary and an outer boundary. At this tab, set the Infill Boundary:

- Select Inner to shut off sections when the implement reaches the inner boundary.
- Select Outer to shut off sections when the implement reaches the outer boundary.

Switches

1. At the Switches tab, tap **Setup**.
2. At the *Add / Edit Implement Lift Sensor* screen, enter the appropriate settings.

Measurement	Explanation
Status	On: Select if you have one or more implement switches tied into your implements control system. Off: Select if you have no implement switches tied into your implements control system.
Number of Switches	Select the number of implement switches that you have tied into your implement control system.
Minimum Changed Switches	Enter the number of implement switches the system should recognize to determine if the implement is lifted.

Delete an implement

To delete an implement:

1. At the *Configuration Selection* screen, tap **Switch** next to the implement.
2. At the *Implement Configuration* screen, select the appropriate implement from the list.
3. Tap **Delete**.
4. When prompted, tap **Yes** to confirm the deletion.

CHAPTER 8

Vehicle guidance setup

In this chapter:

Guidance settings **144**

Manual guidance **144**

Autopilot system **146**

EZ-Pilot assisted steering system **166**

EZ-Steer assisted steering system **172**

Setup for vehicle guidance includes choosing the type of guidance system that your vehicle is configured for.

Guidance settings

- Manual guidance (page 144): For systems without any automatic steering system
- Autopilot system (page 146)
- EZ-Pilot assisted steering system (page 166)
- EZ-Steer assisted steering system (page 172)

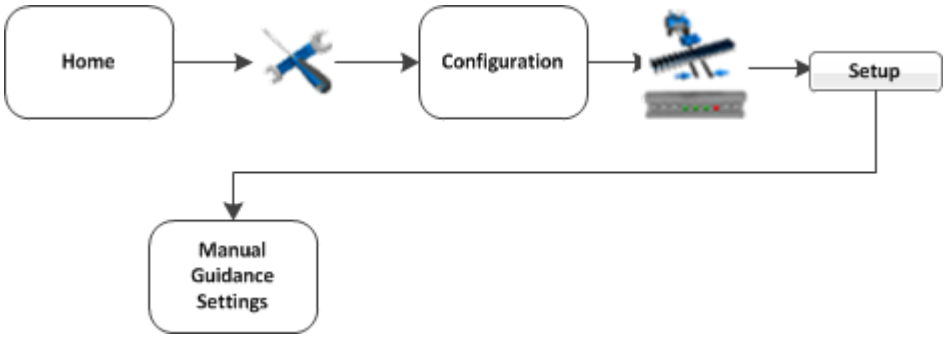
All guidance systems require GPS. See GPS receiver settings (page 98).

For operational information, see:

- Autopilot system operation (page 359)
- EZ-Pilot system operation (page 362)
- EZ-Steer system operation (page 365)

Manual guidance

To set up manual guidance, complete the settings and complete the GPS receiver settings (page 98).



1. At the *Home* screen, tap . The *Configuration* screen displays.
2. Select Manual Guidance and then tap **Setup**. The *Manual Guidance Settings* screen displays.
3. In the Vehicle tab, complete the settings and tap **OK**.

Setting	Explanation
Vehicle Type	Type of vehicle
Axle to Antenna Offset	The horizontal distance between the axle and the antenna. Measure the distance accurately (within 3 inches). An

Setting	Explanation
	incorrect offset may cause poor steering performance. ***Note*** *– Measure the offset distance as accurately as possible (within 3"); an incorrect offset may cause poor steering performance.* • If the antenna is in front of the axle, enter a forward distance. • If the antenna is behind the axle, enter a back distance.
Antenna Height	Measure the antenna height vertically, from the ground to the base of the antenna.
Wheelbase	The horizontal distance between the center of the front wheel and the center of the back wheel.

Note *– Any changes you make to the vehicle settings remain, even if you replace the Manual Guidance option with the Autopilot option.*

4. Complete the GPS receiver settings (page 98).

Autopilot system

Note *– Autopilot system setup is typically done when the system is professionally installed.*

For cabling information, see the *FM-1000 Integrated Display Cabling Guide*.

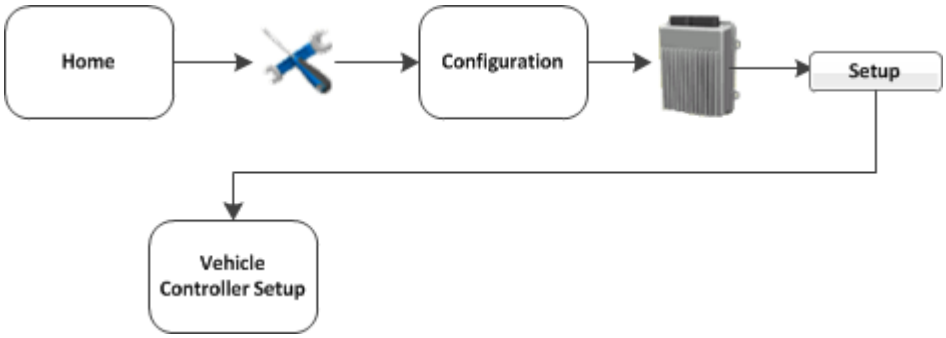
For operational information, see Autopilot system operation (page 359).

The sequence of setting up the Autopilot system is:

1. Complete the GPS receiver settings (page 98) if you have not already done so.
2. Complete the settings for the Autopilot system.
3. Calibrate the Autopilot automated steering system for your vehicle. See Autopilot calibration (page 150).

Note *– The subsequent configuration steps are usually done when the system is professionally installed.*

Begin setup



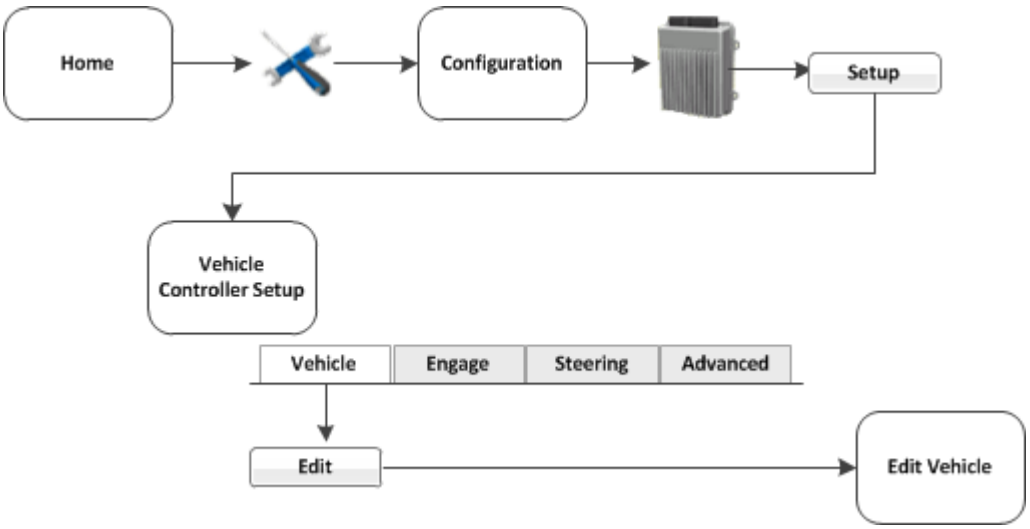
1. At the *Home* screen, tap . The *Configuration* screen displays.
2. Select Autopilot (Vehicle) and tap **Setup**. The *Vehicle Controller Setup* screen displays.

Vehicle settings for Autopilot system

Complete the settings in the Vehicle tab.

Setting	Explanation
Connector	Select the port on the display that the Autopilot system controller is connected to.
Current Selection	Displays the current vehicle profile (.vdb) that is loaded. To change this setting, see Select a vehicle (page 147).

Select a vehicle



1. At the *Home* screen, tap . The *Configuration* screen displays.
2. Select Autopilot (Vehicle) and tap **Setup**. The *Vehicle Controller Setup* screen displays.
3. Tap **Edit**. The *Edit Vehicle* screen displays.
4. From the Vehicle Profile Location list, select the source of the pre-configured vehicle profile you want:
   - Autopilot controller: The majority of vehicle profiles are stored on the Autopilot controller.
   - Vehicle profile database file: As additional profiles become available or are updated, they are added to a vehicle profile database. You can download the database and load profiles from it.
   - Saved file: You can install an individual vehicle profile that you configured previously and saved. See Save vehicle profile (page 165).

For Vehicle Profile Location, if you choose...	Then...
From Controller (New)	a. From the Model list, select the make and model you want. b. Tap **Use Vehicle**.
From Database (new)	a. Tap **Browse**. b. Select the .vdb file you want. c. Tap **OK**. d. Tap **Use Vehicle**.
From Saved File (existing)	a. Tap **Browse**. b. Select the file you want. c. Tap **OK**. d. Select **Save Vehicle** to save the new settings. e. When a message displays that the profile you selected on the NavController, tap **OK**. ***Note*** *– If you select a vehicle make and model but do not upload that configuration to the Autopilot controller, that make and model may not be loaded.* f. Tap **OK** when another message displays explaining the NavController will be reinitialized.

Engage settings for Autopilot system

At the Engage tab, complete settings related to the engagement of the Autopilot system.

Setting	Explanation
Operator Timeout	The amount of time of inactivity before an operator timeout message displays.
Coverage Log	How coverage logging occurs: • Manual: Coverage logging only occurs when you tap . • When Engaged: Coverage logging occurs when Autopilot steering

Setting	Explanation
	is engaged, by tapping (yellow). See Engage button (page 317).

Steering settings for Autopilot system

At the Steering tab, complete the settings related to steering on the guidance line.

Setting	Explanation
Nudge Increment	The distance the Nudge buttons in the *Run* screen move to for the vehicle to line up with the guidance line.
End of Row Warning Dist	The distance the vehicle is from the end of a row to trigger the end-of-row warning.
AutoSense	On or off. ***Note*** *– Most recent Autopilot systems use an AutoSense device require this setting to be On.*
Valve on Speed	• Normal: Speed threshold >0.4 m/s (1.3 ft/s). For normal operating speeds. • Low: Speed threshold >0.1 m/s (0.3 ft/s). For vehicles operating and very slow speeds. • Ultra Low: Speed threshold >0.2 m/s (0.7 ft/s). For vehicles operating and very slow speeds. ***Note*** *– The NavController must have firmware version 5.10 or higher to support low and ultralow settings.*
Legacy Sensors	For older Autopilot systems that use the electrical system to measure vehicle status. • None • Wheel Speed Only • Gear Level Only • Wheel and Gear This list is only available when AutoSense is set to Off.

Advanced settings for Autopilot system

Advanced settings are located in the Advanced tab. For more information regarding the Advanced tab settings, contact your local reseller.

Autopilot calibration

After you configure the vehicle make and model, calibrate the system for your vehicle. The calibration process records additional details about your vehicle which helps the system to steer the vehicle more accurately. For high accuracy systems, all settings must be correct.

All vehicle types

Four calibration items are required for all types of vehicles:

- Controller orientation (page 151): Correctly associates the outputs of the Autopilot controller sensors with the direction of the vehicle.
- Manual Override Sensitivity calibration (page 152): Required for platforms that employ a pressure transducer for the manual override function. Change the default only if the operation of the manual override function is acceptable.
- Roll / antenna compensation calibration (page 158): Compensates for antenna height and static roll caused by minor variations in the Autopilot controller and the GPS receiver mounting.
- Line acquisition aggressiveness calibration: How aggressively the vehicle approaches the guidance line

Articulated and front-wheel-steered types

For articulated and front-wheel-steered vehicle types, additional calibrations are required:

- Steering angle sensor calibration (page 153): Converts the sensor output into commands for steering full left, full right and any position in between.
- AutoSense calibration (page 153): Orients Autosense.
- Automated Deadzone calibration (page 154): Required to learn the vehicle's steering deadzone.
- Proportional steering gain calibration (page 156): Required only if system steering performance is not satisfactory.

Tracked tractors

For tracked tractors, there are several calibrations required. See Tracked tractor calibrations (page 162).

Begin calibration

1. At the *Home* screen, tap .
2. At the*Configurations* screen, tap **Setup** next to the vehicle.
3. Select Autopilot (Vehicle) and tap **Calibrate**. The *Vehicle Calibration* screen displays.
4. Select a calibration and tap **OK**.

Controller orientation

1. At the *Vehicle Calibration* screen, select Controller Orientation and tap **OK**. The *Autopilot Controller Orientation* screen displays. A graphic of the controller represents the current mounting orientation of the controller.

   The image is shown as though:

   - You are looking down on the vehicle from above.
   - The top of the screen points to the nose of the vehicle.
2. Use the buttons to select the orientation of the controller.

   If the controller is set at a sloped angle, the vehicle profile will set the NavController orientation.

   Note *– Install the NavController as described in the vehicle install instructions. If custom angles are used, the on-screen image of the controller does not display.*
3. Tap **OK** to accept the new orientation or tap **Cancel** to exit.

Manual Override Sensitivity calibration

WARNING – Incorrect adjustment of the Manual Override Sensitivity calibration setting could cause this critical safety feature to fail, resulting in personal injury or damage to the vehicle. Any adjustment to this setting must be made only by an authorized dealer.

Note – *Manual Override Sensitivity calibration is valid only for platforms that employ a pressure transducer for the manual override function. The software automatically detects whether or not the vehicle configuration includes this type of sensor and provides this option if required.*

Manual override is one method of disengaging the Autopilot system by turning the steering wheel. When you turn the steering wheel, there is a voltage spike that then tapers off. This spike and decline occurs at different levels for different models of tractor.

The manual override sensitivity is the level that the voltage must spike to before the override occurs and the system disengages. The voltage must also taper below that level before automated steering can be engaged again. If you set a:

- High level of sensitivity, the system will disengage more quickly and you will have to wait longer before you can re-engage.
- Low level of sensitivity, the system will take longer to disengage and you will be able to re-engage more quickly.

Incorrect adjustment of the Manual Override Sensitivity calibration setting could cause this critical safety feature to fail, resulting in personal injury or damage to the vehicle. Any adjustment to this setting must be made only by an authorized dealer.

We strongly recommend that you perform this calibration only if the default sensitivity is unacceptable under all conditions. ***Do not to choose a sensitivity setting that is either too sensitive or not sensitive enough***. In either case, manual override may cease to function correctly. On some platforms, you could set the sensitivity so low that the manual override function will not detect any steering wheel motion. It is vital that you avoid this.

Calibration steps

1. At the *Vehicle Calibration* screen, select Manual Override and tap **OK**. The *Autopilot Manual Override Calibration* screen displays.
2. Test the current manual override setting. Turn the steering wheel. The **Override Inactive** button changes color when the Override becomes active. With the system active, assess whether the manual override feature is at an acceptable level of sensitivity for:
   - Speed of steering wheel turn
   - Distance of steering wheel turn
3. To adjust the manual override sensitivity setting, move the slider bar.

Slider Bar Direction	Sensitivity is...	Manual Override is triggered...
Left	Increased	More easily
Right	Decreased	Less easily

The value above the slider bar on the right is the current setting. The total range of the slider bar is 0.5 to 2.5 (where 0.5 is the most sensitive setting and 2.5 is the least sensitive).

4. To try the new setting, tap **OK**. The *Vehicle Calibration* screen displays.
5. Select Manual Override again. The *Autopilot Manual Override Calibration* screen displays again.
6. Repeat steps 1 through 4 to test each new setting.

   Note *– You can also evaluate the performance of the manual override feature under conditions of loading and/or activities which may affect the pressure of the hydraulic system. For example, you can turn on the auxiliary hydraulics while you evaluate the manual override sensitivity.*

7. Tap **OK** to accept the new setting or tap **Cancel** to exit.

AutoSense calibration

1. At the *Vehicle Calibration* screen, select Autosense Calibration and tap **OK**. The *Autopilot AutoSense Calibration* screen displays.
2. From the Location list, select the AutoSense position.
3. From the Orientation list, select the AutoSense orientation.
4. Tap **OK** to confirm selections.

Steering angle sensor calibration

Note *– Perform the steering sensor calibration only if a rotary potentiometer is installed on the vehicle. If an AutoSense device is selected as the steering angle sensor, the Steering Sensor screen does not appear.*

Steering sensor calibration converts the voltage output of the steering sensor into an equivalent steering angle measurement.

Note *– Complete this calibration before you attempt to calibrate the steering deadzone or roll correction procedures.*

This calibration requires the vehicle to be in motion. Ensure that you:

- Perform this procedure on a hard, level surface that is free of obstructions.
- Maintain a tractor speed above 1.6 kph (1 mph).
- Watch the Sensor Angle value:
  - For a symmetrical angle reading at the steering extremes while you manually steer the wheels to full right and full left

- To ensure that the angle reading is near zero while you manually steer the wheels straight ahead

Calibration steps

To run the steering sensor calibration:

1. At the *Vehicle Calibration* screen, select Manual Override and tap **OK**. The *Autopilot Steering Sensor Calibration* screen displays.
2. Move the tractor forward slowly.
3. Center the steering wheel and then tap **Next**.
4. Turn the steering wheel completely to the left and then tap **Next**. If the steering wheel is not turned completely to the left or if the steering sensor requires adjustment or replacement, an error message displays.

   The value for Volts updates as you turn the steering wheel:
5. Turn the steering wheel completely to the right and then tap **Next**. If the steering wheel is not turned to the full right position or if the steering sensor requires adjustment or replacement, an error message displays.
6. At the next screen, center the steering wheel. While the wheel is at the center position, tap **Next**.

   The value for Volts updates as you turn the steering wheel.
7. Tap **OK** to accept the calibration.

Automated Deadzone calibration

WARNING – During the Automated Deadzone calibration, the system moves the wheels that steer the vehicle. To avoid injury, be prepared for sudden vehicle movement and that the area around the vehicle (and implement, if applicable) are clear.

WARNING – Obstacles in the field can cause collisions, which may injure you and damage the vehicle. If an obstacle in the field makes it unsafe to continue the Automated Deadzone calibration, stop the vehicle and turn the steering wheel to disengage the system.

1) Wait until the display prompts you that the phase is ready to begin.
2) Look at the screen to determine whether the next phase will require a left or right turn.
3) Reposition the vehicle so that the turn will use the space that you have available.
4) Tap the button to begin the next phase.

The Automated Deadzone calibration runs a series of tests on the valve and steering hydraulics to determine the point at which steering movement occurs.

In this test, the system independently opens and closes each side of the steering system while determining the point at which wheel movement occurs.

- You must complete the Steering Angle procedure before you run this procedure.
- To ensure optimal system performance, the hydraulic fluid must be at normal operating temperature when you run this procedure. On some vehicles with large reservoirs, it may take several hours for the fluid to reach operating level, especially if the implement circuit is lightly loaded. Consult the vehicle documentation to determine if the hydraulic fluid temperature can be shown on a vehicle console.
- If you perform the calibration while the system is still cold, repeat both the Deadzone and the Proportional gain calibration procedures after the system is at operating temperature.

Calibration steps

Place the vehicle in a large field that is free of hazards. To minimize the effect of the ground conditions, the field should have smooth soil that is loose but firm.

At the *Vehicle Controller Setup* screen, select Automated Steering Deadzone and tap **OK**. The *Autopilot Automated Deadzone Calibration* screen displays.

1. Tap **Next**.
2. Tap **Next** in the two screens that display.
3. Follow all instructions. Tap the **Test Right** and **Test Left** buttons to perform the Deadzone calibration.
4. As ground conditions affect the results of this calibration, it is recommended that you perform the calibration at least three times, or until the average deadzone values change by less than about 0.5.

   To minimize the total amount of space needed for the complete calibration, you can reposition the vehicle between the phases of the test. If the available flat, smooth space is extremely limited, re-align the vehicle after each segment of the calibration.

   To reposition the vehicle:

   a. Wait until the software prompts you that the next phase is ready to begin.
   b. Look at the screen to determine whether the next phase will require a left or right turn.
   c. Reposition the vehicle so that the turn will use the space that you have available.
   d. Tap the button to begin the next phase.
5. Reposition the vehicle and continue from the current test phase.

Automated Deadzone error messages

Error -	Explanation
Manual Override Detected	Manual override was detected before the calibration cycle could be completed. Retry.
Vehicle Moving Too Slow	The vehicle was moving too slowly for the calibration cycle

Error -	Explanation
	to successfully finish. Make sure the vehicle is moving at least 0.8 kph (0.5 mph) during each calibration cycle.
Steering Close To End Stops	Before the calibration cycle could be completed, the measured steering angle approached the end stops. Retry, and if the problem persists, instead of centering the steering at the start of each cycle, try turning the steering in the opposite direction to that which is being tested so that the calibration procedure has a greater range to test over.
Valve Connectors Could Be Swapped	The calibration test sensed the steering turning in the opposite direction to what was expected. Retry, and if the problem persists either the valve connectors have been accidentally swapped or the steering sensor calibration was performed incorrectly.
No GPS	A GPS receiver must be connected and outputting positions before the software can run the calibration procedure.
No Steering Response Detected	During the calibration cycle, insufficient movement was sensed for the calibration to complete. If the problem persists, the hydraulic installation could be faulty.
Unable To Determine DZ: Try Again	A problem occurred when trying to compute dead zone. Retry, and if the problem persists, contact Technical Support.
Software Problem Detected	The software was unable to complete the calibration due to insufficient movement of the vehicle. If the problem persists, contact Technical Support.

Proportional steering gain calibration

WARNING – The wheels can move abruptly during the Proportional Steering Gain procedure while the Autopilot system tests the hydraulic response to the steering commands. These sudden movements can cause collisions with nearby obstacles or cause injury to occupants of the vehicle. Be prepared for sudden wheel movements.

***Note** – Complete the steering sensor calibration **before** you perform the proportional gain calibration. Perform the proportional steering gain calibration **only** when the Autopilot system performance is less than satisfactory.*

The Proportional Steering Gain (PGain) setting enables a balance between rapid steering response and stability. When you modify the PGain setting, two steering characteristics are affected:

- Slew Time: The amount of time that the front wheels take to move from the far left to the far right position and vice versa.
- Overshoot: The percentage by which the front wheels exceed the commanded angle before they settle on the correct value.

To correct slight variations caused by valve current response, friction, and hydraulic fluid viscosity, alter the PGain value:

- High PGain value: Decreases the slew time and increase the overshoot. This provides rapid responses, but can cause the steering to exhibit signs of instability (for example, a tendency to excessively overshoot).
- Low PGain value: Increases the slew time and decrease the overshoot. This improves the stability but can introduce significant delays in the steering response and can cause the vehicle to oscillate from side to side.

Perform the calibration:

- Immediately before you run the PGain calibration, even if the Automatic Deadzone calibration has been performed in the past.
- On a hard, level surface that is free of obstructions.
- While maintaining a vehicle speed above 1.6 kph (1 mph)

Increase the proportional gain up to the point just before any one of the following occurs:

- Slew times no longer decrease (a low value is required)
- Overshoot exceeds 5 – 8% (depending on the vehicle)
- Wheels noticeably shake near end stops

Calibration steps

1. At the *Vehicle Calibration* screen, select Steering Gain and tap **OK**. The *Autopilot Steering Gain Calibration* screen displays.
2. Tap **Run Slew Test**. A warning message displays.
3. Tap **Next**.

WARNING – The wheels can move abruptly during the Proportional Steering Gain procedure while the Autopilot system tests the hydraulic response to the steering commands. These sudden movements can cause collisions with nearby obstacles or cause injury to occupants of the vehicle. Be prepared for sudden wheel movements.

4. Tap **Next** in the next two screens that display.
5. Test various gain settings while you monitor the vehicle performance and the values for Slew Time and Overshoot for the Turn Left phase.

a. Adjust the New Gain (if required).

b. Turn the front wheels completely to the right to begin the test. (The test is for the stop-to-stop position.)

c. Tap **Turn Left**. Both turn buttons are unavailable while the wheels slew.

Note *– The optimum gain setting has short slew time (short millisecond reading) and low overshoot percentage (less than 5–8%).*

6. Repeat Step 5 with **Turn Right**. Both turn buttons are unavailable while the wheels slew.
7. When you locate the best gain value, either:
   - Tap **OK** to save the value in the Autopilot controller memory.
   - Tap **Cancel** to restart the calibration procedure.

Roll / antenna compensation calibration

Note *– Antenna offsets are provided when the antenna cannot be placed directly over the working point of the implement. It is recommended that these offsets are minimized whenever possible.*

At the *Vehicle Calibration* screen, select Roll/Antenna Correction and tap **OK**. The *Autopilot Roll/Antenna Compensation* screen displays.

Precalibration

Before configuring the antenna compensation, make sure that:

- The Autopilot system is completely and correctly set up.
- GPS corrections are set up.
- You read this section carefully.
- If multiple GPS technologies will be used (for example, RTK and SBAS), use the technology with the highest accuracy when you perform the Roll Correction calibration.

Calibration steps

1. Set the antenna height above the ground.
   a. Place the tractor on a flat, level surface.
   b. Measure the distance from the ground to the base of the GPS receiver (or antenna).
   c. Enter this value for Antenna Height Above Ground.
2. Set the antenna distance from the fixed axle.
   a. Place the tractor on a flat, level surface.
   b. Measure the distance from the fixed axle to the center of the GPS receiver (or antenna).

c. Enter this value into the Antenna Distance from Fixed Axle entry box. Enter a negative value if the GPS receiver antenna is to the rear of the fixed axle. The nose of the vehicle is considered the forward direction.

3. Configure the roll offset correction.

   Use one of the following methods to calculate the roll offset and then enter the roll offset correction to compensate for it:

   - Tire track offset method
   - Flag offset method

     Choose the method which best matches the conditions.

4. Enter the roll offset value for roll offset.
5. Select one of the offline direction options, depending on whether the roll offset distance is to the right or left.

Tire track offset method for roll offset

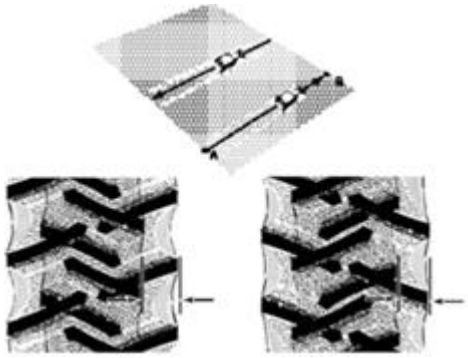
Note *– Use a highly repeatable GPS correction mode for roll correction. For best results, use a RTK mode or OmniSTAR HP signal that has been converged for at least twenty minutes. If you do a roll calibration with less accurate GPS correction modes, repeat the measurements* ***at least four times*** *to ensure a more consistent result.*

1. Remove any implement from the vehicle.
2. Drive the tractor to a relatively flat field where tire impressions are visible and where you can complete passes of at least 400 m (1320 ft) in length.
3. Reset the roll offset value to 0 (zero).
4. Create an AB Line.
5. Create a clean set of tire tracks in the field. To do this, start a new pass away from the area where the AB Line was created. When the system is stable, engage automatic steering mode and allow the Autopilot system to complete the pass.
6. At the end of the pass, turn the tractor around to return along the same pass from the opposite direction.
7. Engage automated steering mode and allow the system to complete the pass.
8. In the middle of the return pass, stop the tractor and confirm that the current position is directly on the AB Line. This ensures there is no cross track error.
9. Park the tractor and exit the cab. Evaluate the tire track pattern between the first and return paths.
10. Measure the difference between the track passes and record the distance. Also note whether the return pass is to the left or the right of the original pass. Record the results.

    Note *– The offset should be consistently to the left or right.*

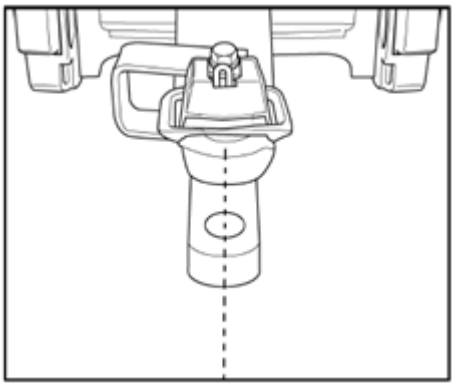
11. Repeat Step 5 through Step 10 two more times, for a total of three test runs.

Test Run	Offset distance	Offset direction
1		
2		
3		
Total =		
Total / 3 (average offset value) =		



Flag offset method for roll offset

1. Remove any implement from the vehicle. The vehicle draw-bar must be centered.
2. Drive the vehicle to a relatively flat area where you can complete passes that are at least 400 m (1320 ft) in length.
3. Reset the *Roll Offset* value to 0 (zero) on the *Roll Correction* screen. See Roll / antenna compensation calibration (page 158).
4. Create an AB Line.
5. Start a new pass. Engage automatic steering mode when the system is stable. Stop the tractor midway through the pass. Confirm that there is no cross track error: the current vehicle position should be directly on the AB Line.
6. Park the vehicle and exit the cab. Use the hitch pin hole in the drawbar as a guide to insert a flag in the ground to mark the vehicle center-line for this pass.



7. Complete the pass. Turn the vehicle around to return along the same pass from the opposite direction.
8. Engage automatic steering mode. Stop the vehicle midway down the pass with the drawbar pin location very close to the marker flag. Confirm that there is no cross track error: the current vehicle position should be directly on the AB Line.
9. Park the vehicle and exit the cab. Use the hitch pin hole in the drawbar as a guide to insert a second flag in the ground to mark the tractor centerline for this pass. Note whether the second pass is to the left or the right of the first pass.
10. Measure the difference between the flags for the two passes and record the distance. Also record whether the return pass is to the left or the right of the original pass. Record the results.

    Note *– The offset should be consistently to the left or right The following graphic shows an example of a right offset. Measure the distance between the flags.*

11. Repeat Steps 5 to 10 two more times for a total of three test runs. Use the following table to record the offset distance and the left or right direction of offset for each test run.
12. Average the results of the three runs. (Total the offset distances from the three passes and divide by three). Repeat Step 5 through Step 10 two more times, for a total of three test runs.

Test Run	Offset distance	Offset direction
1		
2		
3		

Test Run	Offset distance	Offset direction
Total =		
Total / 3 (average offset value) =		

Tracked tractor calibrations

If you selected a tracked tractor as the make and model, the Track Spacing option displays on the calibration list. (This option is not shown in the *Vehicle Calibration* screen.)

Track Spacing value

At the *Autopilot Track Spacing Calibration* screen, enter the distance between the center of the tracks. The width of the vehicle tracks is the distance from halfway across the width of the left track to halfway across the width of the right track.

Hydraulically-steered tracked tractor

If you selected a hydraulically-steered tracked tractor as the make and model, *Engine Speed* displays on the calibration list.

This group of vehicles includes the CAT/AGCO Challenger Tracked family.

No calibration is required if the system is installed on a CAT MT 700/800 series equipped with the ISO option. This also includes John Deere tracked vehicles.

Autopilot RPM Sensor Calibration screen

The *Autopilot RPM Sensor Calibration* screen enables you to verify that the RPM sensor output is correct.

If the *Engine RPM* value is not close to the actual engine RPM, follow the onscreen instructions to adjust the sensor output.

Autopilot Hydraulic Pump Response Time Calibration screen

The *Autopilot Hydraulic Pump Response Time Calibration* screen verifies and optimizes the response of the hydraulic steering pumps. Follow the onscreen instructions to perform the calibration.

Autopilot Steering Pump Knees Calibration screen

This calibration determines the compensation required for dead-band in the steering pumps.

WARNING – The vehicle needs to move during the Hydraulic Tracked Pump Knees calibration procedure. To avoid injury, be prepared for vehicle movement.

The instructions for this calibration test include several screens. Follow the instructions on each screen.

Tracked vehicle steering wheel calibration

1. Turn off the engine, but keep the ignition key in the run position.
2. At the *Autopilot Calibration* screen, select Steering Interface Calibration.
3. ***Keep to the suggested time interval*** and follow the on screen instructions to turn the steering wheel right and left, full lock.
4. Follow the on-screen instructions until Calibration Complete displays on screen.

Row Guidance

Note *– The Autopilot system with a supported vehicle is required for Row Guidance. For the list of supported vehicles, please refer to the RG-100 Supported platforms list.*

When Row Guidance has been activated on the FM-1000 integrated display, the Autopilot system will follow curved or hillside corn rows that do not exactly match the guidance line.

Row Guidance setup

Before setup, make sure you have activated Row Guidance for use. See Activate features/plugins for use (page 45).

1. At the *Configuration* screen, select Row Guidance and then tap **Setup**.
2. The *Row Guidance Configuration* screen displays. Complete the settings and tap **OK**.

   Note *– Verify the measurements are accurate for your vehicle. Measurements can differ due to vehicle variations. Measure distances with the header at the approximate operation height. Inaccurate measurements will result in a degraded performance.*

Setting	Explanation
Header	Header model attached to your combine.
Feeler to Axle Offset	Distance from the pivot point of the feeler to the front axle. This measurement must be accurate to within an inch, otherwise the performance will be degraded.
Cutter Bar to Axle Distance	Distance from the front of the cutter bar or point where the crop enters the snapper rollers to the center of the front axle. This measurement must be accurate, otherwise the performance will be degraded.
Feeler Left/Right Offset	Distance of the center of the row crop feelers to the

Setting	Explanation
	centerline of the vehicle.
Engage Delay	This delay in seconds (0 - 10) will be used when the system is engaged. The system will wait the entered time until inputs are recognized to start row guidance. Use this setting to keep the system from mistaking random stalk strikes on headlands as inputs for steering.
Clear Nudge When Disengaged	Yes: Clears the AutoPilot nudges when the system is disengaged. No: Keep the AutoPilot nudges when the system is disengaged.

3. At the *Configuration* screen, tap Row Guidance and then tap **Diagnostics**.

Item	Explanation
Offline Distance	
Status	Status of the sensor
Enable / **Disable**	Tap to enable or disable sensors
Voltage	Voltage for the left and right sensor
Voltage status	Status for the left and right sensor

Implement setup for Row Guidance

Before starting the Row Guidance setup, ensure that:

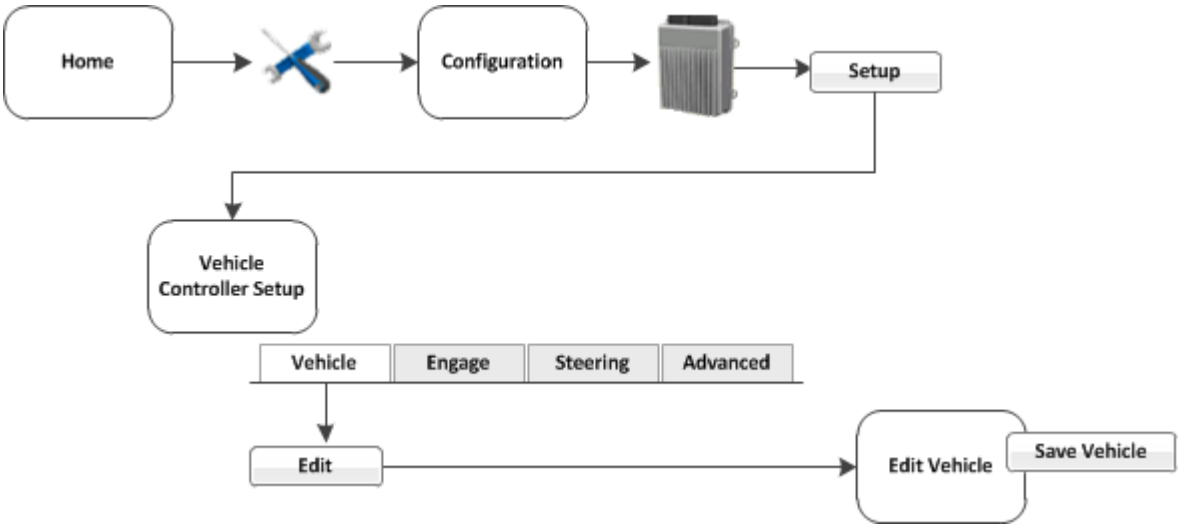
- All cables and components of the system are installed on the vehicle.
- The Autopilot system has been installed and configured with the NavController firmware.
- When setting up Autopilot for use with the RG-100 system, ensure that:
  - A vehicle profile that ends in RG-100 is selected at the *Vehicle Controller Setup* screen
  - The XML header file in the latest release of the vehicle database (.vdb) has been added to the vehicle profiles on the FM-1000 integrated display. Firmware versions after v 6.63 contain an XML file. For instructions on updating the XML file, refer to the support note Autopilot System: Installing the VDB File (v6) .
  - Row Guidance has been added (activated) for the display.

1. At the *Home* screen, tap . The *Configuration Selection* screen displays.
2. Tap **Edit** next to Implement. The *Configuration* screen displays.
3. Tap **Add/Remove** to add Row Guidance to the configuration.

Save vehicle profile

Note *– From Autopilot firmware version 3.0 and later, the vehicle profile location defaults to "From Database".*

After you configure and calibrate the Autopilot system for your vehicle, you can save that information for later use. This can be useful if you want to adjust the settings or if you move the display from one vehicle to another.



To save a vehicle profile:

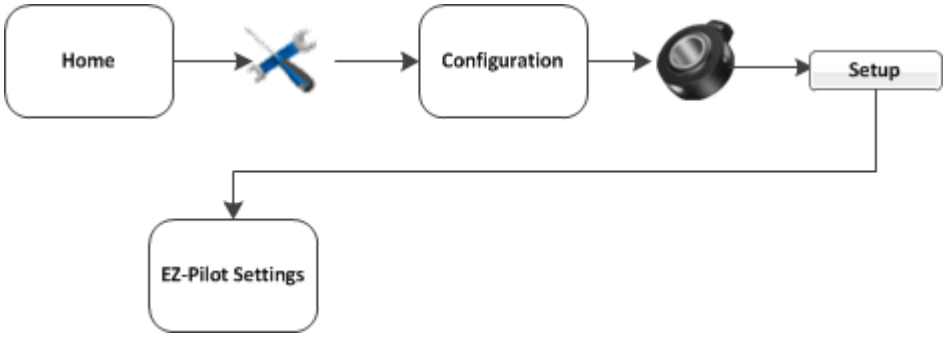
1. At the *Home* screen, tap .
2. Select Autopilot and then tap **Setup**. The *Vehicle Controller Setup* screen displays.
3. On the Vehicle tab, tap **Edit**. The *Edit Vehicle* screen displays.
4. Tap **Save Vehicle**.
5. At the *Save Vehicle Configuration* screen, tap in the Filename entry box.
6. At the *Enter Save Filename* screen, enter a name for the current vehicle profile and tap **OK**.
7. At the *Edit Vehicle* screen, tap **OK**.

EZ-Pilot assisted steering system

The EZ-Pilot assisted steering system uses GPS to provide automatic vehicle guidance.

For cabling information, see FM-1000 Integrated Display Cabling Guide.

For operational information, see EZ-Pilot system operation (page 362).



To set up the EZ-Pilot system:

1. Complete the GPS receiver settings (page 98).
2. Complete the EZ-Pilot settings.
3. Calibrate the EZ-Pilot system.

Vehicle settings for EZ-Pilot system

1. At the *Configuration* screen, select EZ-Pilot and tap **Setup**. The *EZ-Pilot Settings* screen displays.
2. On the Vehicle tab complete the settings as appropriate.

Setting	Explanation
Vehicle Type	Type of vehicle
Axle to Antenna Offset	The horizontal distance between the axle and the antenna. Measure the distance accurately (within 3 inches). An incorrect offset may cause poor steering performance. Take the measurement from the antenna to the correct point of your vehicle: • From the rear axle for MFWD, Sprayer, Floater, Truck • From the front axle for 4WD tractor, Combine, Swathers (For swathers, it is recommended that you place the antenna directly

Setting	Explanation
	over or ahead of the front axle.) • From the tracked center for tracked vehicles If the antenna is: • In front of the axle, enter a forward distance. • Behind the axle, enter a back distance.
Antenna Height	The distance between the ground and the top of the GPS antenna.
Wheelbase	The horizontal distance between the center of the front wheel and the center of the back wheel.

Steering settings for EZ-Pilot system

On the *EZ-Pilot Settings* screen at the Steering tab, complete the settings for steering.

Setting	Explanation
Nudge Increment	The distance the Nudge button on the *Run* screen moves when you tap it.
Angle Per Turn	The angle the wheels turn during one full rotation of the steering wheel. If the setting is too: • Low: The system will turn the wheel too much and the vehicle will perform S-turns. • High: The system will turn the wheel too little and the vehicle will not hold the line.
Freeplay Left	Adjust if the vehicle drives consistently to the right of the line.
Freeplay Right	Adjust if the vehicle drives consistently to the left of the line.
Motor Speed	The maximum rate at which the SAM-200 will operate.
Online Aggressiveness	How aggressively the EZ-Pilot system corrects the deviations from the current guidance line. A setting that is: • Very high: Will correct deviations quickly, but the vehicle may steer erratically. • Very low: Will allow a smoother drive down the swath, but the vehicle may go further offline before the deviation is corrected.
Approach Aggressiveness	How quickly the EZ-Pilot system steers the vehicle onto the

Setting	Explanation
	current guidance line. A setting that is: • Very high: Steers the vehicle quickly, but the steering correction may be too severe. • Very low: Steers the vehicle very slowly, but the vehicle may overshoot and travel too far down the swath before reaching the guidance line.

Engage settings for EZ-Pilot system

At the *EZ-Pilot Settings* screen on the Engage tab, you can edit the system's engage and disengage behavior if you need to change the settings.

Setting	Explanation
Operator Time Out	If the steering system is engaged and there has been no operator interaction with the display for longer than the operator timeout period, a message displays on the screen. If you acknowledge the message within 30 seconds, the system does not disengage. Otherwise, the EZ-Pilot system steering disengages.
Minimum speed	Minimum speed at which the system can engage. If the system is engaged and the speed drops below this limit, the system disengages.
Maximum speed	Maximum speed at which the system can engage. If the system is engaged and the speed increases above this limit, the system disengages.
Maximum angle	Maximum angle at which the system can engage. If the vehicle approaches the swath at an angle greater than this limit, it cannot be engaged.
Engage offline	Maximum distance from the swath at which the system can engage. If the vehicle approaches the swath at a distance greater than this limit, it cannot be engaged.
Disengage offline	Maximum distance from the swath at which the system can remain engaged. If the vehicle drives offline greater than this limit, the system disengages.
Coverage log	Displays on the *Run* screen to show what areas have been applied.

Setting	Explanation
	• Select When Engaged to automatically show coverage logging when the system is engaged. See Engage button (page 317). • Select Manual to show coverage logging only when you tap .
Override sensitivity	Amount the steering wheel must be turned manually before the system disengages.

EZ-Pilot system calibration

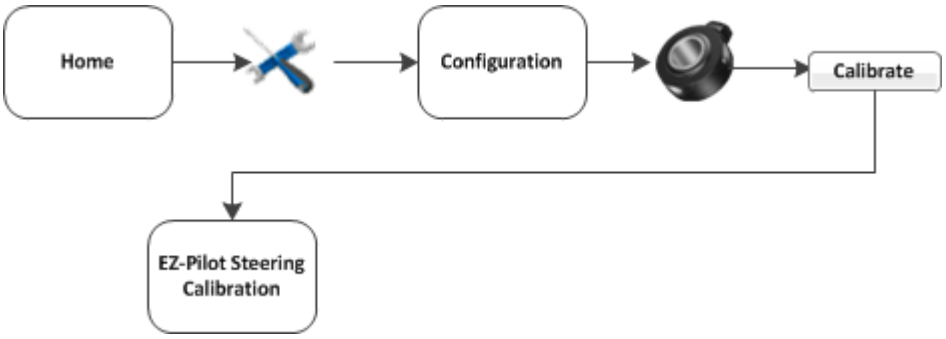
To calibrate the EZ-Pilot system to work with the FM-1000 integrated display, you must complete the following:

1. Enter the vehicle settings.
2. Complete calibration for T3™ roll compensation. See T3 roll compensation calibration (page 171).
3. Calibrate the EZ-Pilot system:
   - Angle per turn (see SAM-200 calibration (page 169))
   - Aggressiveness and Freeplay offset (see Steering performance calibration (page 170))
4. Confirm the calibration settings.

***Note** – You may have to perform the EZ-Pilot calibration more than once to achieve optimal results.*

SAM-200 calibration

***Note** – You must calibrate the IMD-600 before you calibrate the SAM-200.*



1. At the *Configuration* screen, select EZ-Pilot and then tap **Calibrate**. The *EZ-Pilot Steering Calibration* screen displays.

2. Select SAM-200 and tap **OK**.
3. Ensure that you are operating the vehicle in an open field with ample area for the vehicle to make right and left turns.
4. For best results, operate the vehicle at between 2 and 4 mph.
5. To calibrate the right turn angle:
   a. Drive straight forward until (yellow) displays.
   b. Tap . Allow the system to operate for 20 seconds until you receive a message that the calibration is complete.

   WARNING – Auto guidance systems cannot avoid items in the field such as obstacles. Make sure you are adequately trained to operate the auto guidance system.

6. Repeat the steps to calibrate the left turn angle.

Steering performance calibration

To calibrate the EZ-Pilot system and set the correct steering performance parameters, the following steps must be completed with the vehicle moving forward along an A-B line.

1. At the *EZ-Pilot Steering Calibration* screen, select Steering Performance. The *EZ-Pilot Steering Performance* screen displays.
2. Tap the Override Sensitivity tab.
3. Adjust the force required to manually override EZ-Pilot.
4. Tap the Aggressiveness tab. The aggressiveness setting controls the amount of force that required to disengage the system and how aggressively the system holds the line. If the setting is:
   - Too low, the vehicle will not hold the line
   - Too high, the vehicle may over-correct and make S-turns
5. Adjust the Aggressiveness setting to get the vehicle as close to the line as possible without going into S-turns. To make turns:
   - More aggressive: Increase the aggressiveness value.
   - Less aggressive: Decrease the aggressiveness value.
6. Tap the Free Play tab.
7. Adjust the freeplay offset if the steering has greater freeplay in one direction than the other, causing it to drive consistently to one side of the guidance line. To make this adjustment:
   a. Engage the on an AB line.
   b. If the vehicle is offline to the left, increase the freeplay offset to the right.

c. If the vehicle is offline to the right, increase the freeplay offset to the left.

d. Enter the parameters and then tap **OK**. The *EZ-Pilot Steering Calibration* screen displays.

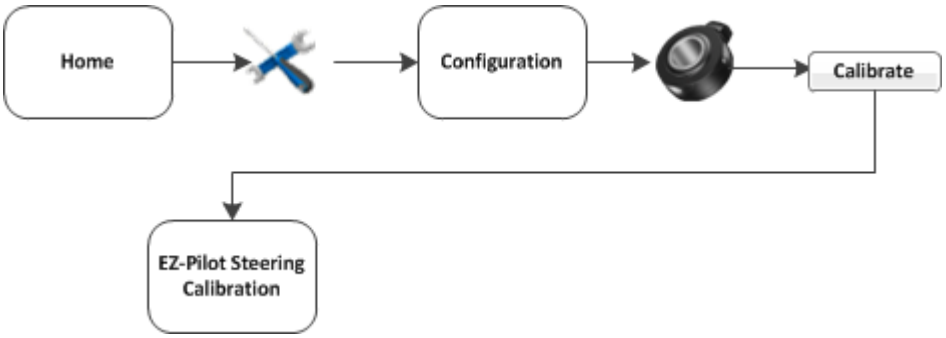
Note *– If you are calibrating a 4WD articulated vehicle, you may need to set the Motor Speed setting to Auto Low.*

Note *– The Advanced Calibration tab is currently not available. To access these options, select EZ-Pilot Diagnostics from the main Configuration screen.*

8. Tap **OK**. The *Configuration* screen displays.

T3 roll compensation calibration

The EZ-Pilot system contains sensors that use T3 terrain compensation technology to provide roll compensation when the vehicle is on a slope or drives over a bump. For roll compensation to work correctly, the IMD-600 must be calibrated.



1. At the *Configuration* screen, select EZ-Pilot and then tap **Calibrate**. The *EZ-Pilot Steering Calibration* screen displays.
2. Select IMD-600 Orientation and tap **OK**. The *EZ-Pilot Roll Calibration* screen displays.

   Note *– For best accuracy, install the IMD-600 as shown in the installation instructions for the supported platform in which it is being installed. Make sure the IMD-600 is installed at right angles to the center line of the vehicle. Non-orthogonal angles will cause performance degradation.*
3. From the Orientation list, select the orientation of the IMD-600 module and then tap **Next**.
4. Park the vehicle, mark the inside position of both sets of wheels and then tap **Next**.

   The display records the roll offset in the first direction. This takes approximately 20 seconds. Do not move the vehicle while the offset is being read.
5. Turn the vehicle around, ensure the wheels are parked over the marks created in step 4 and then tap **Next**.

   The display records the roll offset in the second direction. This takes approximately 20 seconds. Do not move the vehicle while the offset is being read.

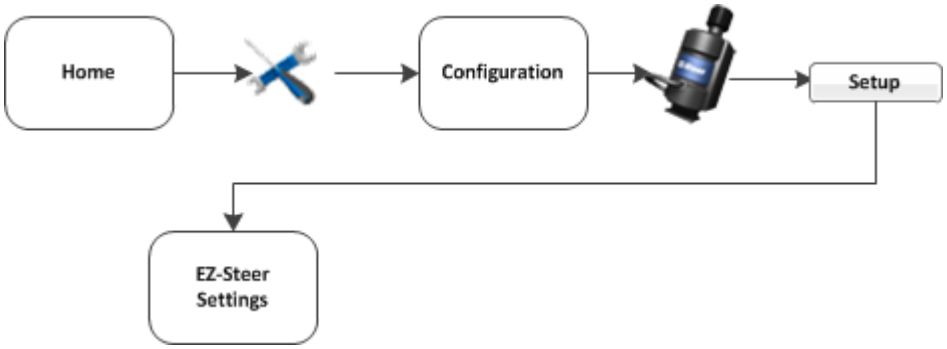
   The T3 calibration results display in the Roll Offset section of the screen. The roll offset value should be between 0° and 4°.
6. Tap **OK**. The *EZ-Pilot Steering Calibration* screen displays.

EZ-Steer assisted steering system

The EZ-Steer assisted steering system uses GPS to provide automatic vehicle guidance.

For cabling information, see FM-1000 Integrated Display Cabling Guide.

For operational information, see EZ-Steer system operation (page 365).



To set up the EZ-Steer system:

1. Complete the GPS receiver settings (page 98).
2. At the *Configuration* screen, select EZ-Steer and tap **Setup**. The *EZ-Steer Settings* screen displays.
3. Complete the settings as appropriate.

Setting	Explanation
Vehicle Type	Type of vehicle
Axle to Antenna Offset	The horizontal distance between the axle and the antenna. Measure the distance accurately (within 3 inches). An incorrect offset may cause poor steering performance. ***Note*** *– Measure the offset distance as accurately as possible (within 3"). An incorrect offset may cause poor steering performance.* • If the antenna is in front of the axle, enter a forward distance. • If the antenna is behind the axle, enter a back distance.
Antenna Height	Measure the antenna height vertically, from the ground to the base of the antenna.
Wheelbase	The horizontal distance between the center of the front wheel and the center of the back wheel.

Note *– The Engage, Steering, and Advanced tabs on this screen are completed automatically with starting values, based on the vehicle type selected.*

4. Tap **OK**. The *Configuration* screen displays.

Engage settings for EZ-Steer

To edit the EZ-Steer system engage settings:

1. At the *EZ-Steer Settings* screen, select the Engage Options tab and complete the settings.

Setting	Explanation
Minimum speed	Minimum speed at which the system can engage. If the system is engaged and the speed drops below this limit, the system engages.
Maximum speed	Maximum speed at which the system can engage. If the system is engaged and the speed increases above this limit, the system disengages.
Maximum angle	Maximum angle at which the system can engage. If the vehicle approaches the swath at an angle greater than this limit, it cannot be engaged.
Engage offline	Maximum distance from the swath at which the system can engage. If the vehicle approaches the swath at a distance greater than this limit, it cannot be engaged.
Disengage offline	Maximum distance from the swath at which the system can remain engaged. If the vehicle drives offline greater than this limit, the system disengages.
Engage on A-B	Set up whether the system can or cannot be engaged on the master A-B line.
Override sensitivity	Amount the steering wheel must be turned manually before the system disengages.
EZ-Steer external switch	Set up the behavior of a seat or foot switch.

2. Tap **OK**. The *Configuration* screen displays.

Advanced settings for EZ-Pilot

At the *EZ-Pilot Settings* screen on the Advanced tab, complete the settings as appropriate.

Setting	Explanation
Roll Offset Angle	Fine-tunes the roll calibration value after it has been determined in the initial calibration process. ***Note*** *– This value is in roll degrees, not distance (inches, cm, and so on) offline.*
Estimate Steering Angle Bias	For long, straight passes, helps drive the lingering cross track error due to erroneous steering angle measurements to zero.
Dynamic Approach Angle (Heading)	When enabled: • Allows for a steeper approach path to the AB line when further away • Reduces the path angle as the vehicle approaches the line ***Note*** *– This setting does not increase the angle at which the system can be engaged from the line, but does increase the approach angle after engagement.*
Steering Slew Limit	Controls the maximum sustained rate that the steering will respond. • Lower value: Steering is smoother and slower. ***Note*** *– A value that is too low may cause vehicle instability.* • Higher value: Steering is quicker and more responsive.
Steering Acceleration Limit	Controls the rate at which the EZ-Pilot system switches from no steering movement to the full steering slew rate. • Lower value: Steering is smoother. ***Note*** *– A value that is too low may cause vehicle instability. Set the value to zero to disable the setting.* • Higher value: Steering is more aggressive.

EZ-Steer system calibration

Before you calibrate the vehicle:

- Ensure that the vehicle's hydraulic oil is up to operating temperature. Refer to the vehicle documentation.
- Ensure that the tire pressure is correct.
- Perform initial calibration without an implement or with the booms folded in on a high-clearance sprayer. After initial calibration is completed, you can fine tune the settings with the implement or booms folded out.

- Choose a field with the smoothest possible surface and perform calibration at the normal operating speed for the vehicle.
- Have a straight AB line available. If you do not create an A–B line before you begin the calibration, the system will prompt you to open a field and create one.

To calibrate the EZ-Steer system:

1. Complete the T2 roll compensation calibration for EZ-Steer system (page 176).
2. Calibrate the EZ-Steer system.
   - Angle per Turn calibration for EZ-Steer system (page 175)
   - Aggressiveness calibration for EZ-Steer system (page 175)
   - Freeplay Offset calibration for EZ-Steer system (page 176)
3. Confirm the calibration settings.

Note *– You may have to perform the EZ-Steer calibration more than once to achieve optimal results.*

Aggressiveness calibration for EZ-Steer system

The aggressiveness setting fine-tunes how aggressively the system holds the line. If the setting is too low, the vehicle will not hold the line. If the setting is too high, the vehicle may over-correct and make S-turns.

To configure the aggressiveness settings, at the *EZ-Steer Steering Performance* screen select the Step 2 tab.

Adjust the aggressiveness setting to get the vehicle as close to the line as possible without going into S-turns. To make:

- More aggressive turns, increase the aggressiveness
- Less aggressive turns, decrease the aggressiveness

Angle per Turn calibration for EZ-Steer system

Angle per Turn is a course adjustment of the angle that the wheels turn through during one full rotation of the steering wheel. If the setting is too low, the system may require several attempts to reach the line.

To calibrate the EZ-Steer system, and set the correct steering performance parameters, complete the following steps with the vehicle moving forward along the A-B line.

Note *– Use the Cross Track Error history plot on the top right of the page and the Average Offline distance to optimize EZ-Steer performance for each step in the calibration.*

1. At the *EZ-Steer Steering Calibration* screen, select Steering Performance. The *EZ-Steer Steering Performance* screen displays.
2. Select the Step 1 tab.

3. With the vehicle moving forward along the A–B line:
   a. Nudge the vehicle left or right 1 m (3') from the A–B line.
   b. Engage the EZ-Steer system.
4. Adjust the Angle per Turn value so that when the system is engaged, the vehicle moves close to the guidance line. To make:
   - More aggressive turns, decrease the value for angle per turn
   - Less aggressive turns, increase the value for angle per turn

Freeplay Offset calibration for EZ-Steer system

Add a Freeplay Offset if the steering has greater freeplay in one direction than the other, causing it to drive consistently to one side of the guidance line.

Note *– If you are calibrating a 4WD articulated vehicle, you may need to set the Motor Speed setting to Auto Low.*

Note *– The Advanced Calibration tab is currently not available. To access these options, select the EZ-Steer* **Diagnostics** *from the main Configuration screen.*

1. To adjust the Freeplay Offset settings, at the *EZ-Steer Steering Performance* screen select the Step 3 tab.
2. Engage the system on the A–B line. If the vehicle is offline:
   - To the left, increase the freeplay offset to the right
   - To the right, increase the freeplay offset to the left

> **WARNING –** Many large and sudden changes in satellite geometry caused by blocked satellites can cause significant position shifts. If operating under these conditions, auto-guidance systems can react abruptly. To avoid possible personal injury or damage to property under these conditions, disable the auto-guidance system and take manual control of the vehicle until conditions have cleared.

3. Enter the parameters and then tap **OK**. The *EZ-Steer Steering Calibration* screen displays.
4. Tap **OK**. The *Configuration* screen displays.

T2 roll compensation calibration for EZ-Steer system

The EZ-Steer system contains sensors that use T2™ terrain compensation technology to provide roll compensation when the vehicle is on a slope or drives over a bump. For roll compensation to work correctly, the controller must be calibrated.

1. Select EZ-Steer and then tap **Calibrate**. The *EZ-Steer Steering Calibration* screen displays.
2. Select Controller Orientation and tap **OK**. The next step in calibration displays.

3. From the Orientation list, select the orientation of the steering control module and then tap **Next**. The next step in calibration displays.
4. Park the vehicle, mark the inside position of both sets of wheels and then tap **Next**. The display records the roll offset in the first direction. This takes approximately 20 seconds. Do not move the vehicle while the offset is being read.
5. Turn the vehicle around, ensure the wheels are parked over the marks created in the previous step and then tap **Next**. The next step in calibration displays.

   The display records the roll offset in the second direction. This takes approximately 20 seconds. Do not move the vehicle while the offset is being read.

   The T2 calibration results will be listed in the Roll Offset section. The Roll Offset value should be between 0° and 4°.
6. Tap **OK**. The *EZ-Steer Steering Calibration* screen displays.

CHAPTER 9

Field-IQ system setup

In this chapter:

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Material setup **185**
Control setup **187**
Equipment calibration for Field-IQ **200**
Upgrade Field-IQ system firmware **213**

When the Field-IQ system is installed, the FM-1000 integrated display can control:

- Planters
- Sprayers
- Air seeders
- Liquid strip-till tool-bars
- Spinner spreaders

Field-IQ system functionality

The Field-IQ system can perform automatic section control using:

- Tru Count Air Clutch®
- Boom valves
- LiquiBlock™
- Various section control devices

While performing automatic section control it can control rates using a prescription with:

- Rawson™ drives
- Servo valves
- PWM valves
- Various flow control devices

The Field-IQ system can be configured to perform different functions.

Application	Main functions
Planter	• Seed Section Control of up to 48 individual rows (Field-IQ system section control module(s) needed) using Tru Count Air Clutches • Seed Rate Control using up to 4 Rawson drives to change seed population • Seed Rate control using up to 4 PWM drives to change seed population • Liquid Fertilizer Control of up to 48 individual liquid nozzles (Field-IQ section control module(s) needed) using Tru Count LiquiBlock valves • Variety tracking
Sprayer	• Liquid Rate Control, using either a PWM or Servo control valve • Liquid Section Control of up to 48 individual spray nozzles (Field-IQ Section Control Module(s) needed) using existing boom shutoff valves or Tru Count LiquiBlock valves
Strip-till (liquid)	• Liquid Section Control of up to 48 sections or individual sections (Field-IQ Section Control Module(s) needed) using Tru Count LiquiBlock valves • Liquid Rate Control using up to 2 Rawson drives connected to ***fixed displacement pumps,*** such as CDS-John Blue piston pumps, to change liquid rate (Field-IQ Rawson Control Module(s) needed) • Liquid Rate Control using either a PWM or Servo control valve and flow

Application	Main functions
	meter
Spreading	• Spreading Rate Control using a Rawson Drive (Field-IQ Rawson Control Module(s) needed) • Spreading Rate Control using either a PWM or Servo control valve and application rate sensor
Air seeder	• Section Control of up to 96 rows of blockage sensors • Section Control of multiple materials simultaneously with manual rate or prescription • Control existing PWM, linear actuators, or servo systems • Auxiliary sensors can read fan speed, bin level, air pressure, and implement switches

For installation and cabling information, see FM-1000 Integrated Display Cabling Guide.

General setup information

Before starting the Field-IQ system setup, ensure that:

- All components of the system are installed on the vehicle and implement.
- Field-IQ has been activated for use. See Activate features/plugins for use (page 45).
- The implement has been set up and configured for the appropriate operation, such as planting or spraying. See Implement setup for Field-IQ (page 181).

For cabling information, see the *FM-1000 Integrated Display Cabling Guide*.

For operational information, see Field-IQ operation (page 347).

Implement setup for Field-IQ

The implement type defines the set up options for the Field-IQ system.

For example, if the material is set to granular fertilizer and the implement is set to sprayer, the system will not allow you to enter a gate height setting.

When running a fertilizer cart, set the implement type to air seeder. This will allow the user to not have to enter gate dimensions.

1. Navigate to the *Implement Setup* screen.
2. On the Implement Type tab:
   a. From the Operations list, choose the operation.
   b. Tap **Edit**. The *Select Implement Layout* screen displays.
   c. Tap the appropriate layout and then tap **OK**.

Operations	Layouts
Spreading	Pull-type spreader Self-propelled spreader
Spraying	Self-propelled, front boom Self-propelled, rear boom Pull-type sprayer
Planting	Standard Front split Rear split Center offset
Seeder	None
Tillage	None
Other	None

3. On the Measurements tab, enter the measurements for the implement.

   These measurements are crucial to the performance of the vehicle and implement in the field.

Measurement	Explanation
Swath Width	The distance between guidance lines. This is typically the working width of your implement, vehicle, or header.
Application Width	The width of a pass including any overlap. This measurement is reflected by the display's coverage map.
Application Offset	The distance between the tractor and the implement: • Guidance Only: This is measured from the fixed axle of the vehicle to the location where the coverage will be mapped. Used to reference from the vehicle to the implement / application point. • Field-IQ: Measured from the fixed axle of the vehicle to the implement tool bar. The offset is measured from the fixed axle of the vehicle to the point

Measurement	Explanation
	on the implement where coverage logging will be mapped. The fixed axle varies depending on vehicle type: • Rear axle on front-steering tractors and self-propelled sprayers • Front axle on 4 x 4 articulated tractors • Center of tracks on tracked tractor ***Note*** *– If you set Application Offset to zero, you will not be able to select Drawbar for the Type in the Geometry tab.*
Rows	Number of rows that are covered by the implement.
Left/Right Offset	This measurement adjusts the tractor path so that an offset implement is centered on the guidance line. It is measured from the center of the vehicle ot the center of the implement or header.

4. On the Geometry tab:
   a. Select the type, which controls how the implement is modeled: Either Hitch / 3 pt or Drawbar.

      Note *– If Application Offset is set to zero in the Implement Type tab, you cannot select Drawbar.*

   b. Enter the appropriate measurement. Some measurements are only available if Implement Monitoring, TrueGuide, or TrueTractor is active.

Measurement	Explanation
Hitch to Ground Contact Point	Measured from the tractor hitch pin to the soil engagement point that the implement rotates about. For planters this is typically the seeding units or the midpoint of several rows of tools.
Antenna Front/Back Offset	Measured from the implement working point to the center of the GPS antenna. This is used only when an GPS antenna is mounted on the implement. When using the TrueGuide system, minimize the antenna offset position. If an antenna offset is required, set the left/right offset first, then limit the offset to the forward distance of 2 m / 80” or less. Back offsets with the TrueGuide system are not accepted.
Antenna Left/Right Offset	Measured from the center of the implement to the center of the GPS antenna. This is used only when the GPS antenna is mounted on the implement. When using the TrueGuide system, minimize the antenna offset

Measurement	Explanation
	positions, They should not exceed 1 m or 40”.
Antenna Height	The working height of the GPS antenna on the implement. This is used only when the GPS antenna is mounted on the implement.

5. On the Overlap tab, choose the correct option for the infill boundary:
   - Outer: Uses the field boundary as the infill boundary
   - Inner: When running a Headland setting, this moves the boundary to the inside of the last headland pass. This allows you to run the inside patterns first before running the headland and then use the inner boundary for section / rate shutoff.
6. On the Switches tab, enable any implement switches that are connected to the Field-IQ system. Tap **Setup**. The *Add/Edit Implement Lift Sensor* screen displays.

Setting	Explanation
Status	Off: No Switches are attached to the Field-IQ system. On: One or more implement switches are attached to the Field-IQ system.
Number of Switches	Select the number of implement switches that are attached to the Field-IQ system. The maximim is 3.
Minimum Changed Switches	Enter the number of implement switches the system should recognize to determine if the implement is lifted. For example, if the total number of switches is 2, and the Minimum Changed Switches is 2, both switches must show raised before determining the implement is in the raised position.

Field-IQ system setup

1. At the *Configuration* screen, select Field-IQ and then tap **Setup**.
2. Tap the appropriate button to continue setup.

Button	Tap to...
Material Setup	Set up a predefined list of materials to use in the *Control Setup* or *Material Assignment* screens. See Material setup (page 185).
Control Setup	Set up control locations and assign Field-IQ system modules.

Button	Tap to...
	See Control setup (page 187).
Material Assignment	Assign materials that were set up in the *Material Setup* screen to the Locations that were set up in the *Control Setup* screen.

Material setup

When you select a material from the Available Materials list, some of its specific settings appear on the right-hand side of the screen. This allows you to check some of the settings needing to view the material.

Add or edit a material

Enter information about the material.

1. At the *Material Setup* screen, tap **Add**. The *Material Details* screen displays.
2. At the Material tab, enter the appropriate settings and tap **Next**. See Material tab (page 188).
3. At the Alarms tab, enter the alarm information and tap **Next**. See Alarms tab (page 186).
4. At the Operation tab, complete the settings and tap **Next**. See Operation tab (page 186).
5. At the Coefficient tab, enter the calibration value with the material. The material may have different calibrations for different locations. This means that you will need to make a different material for each location and name them in such a way (for example, Wheat Front Bin, Wheat Rear Bin) that you will know which location to use them in. When you have entered the coefficient, tap **OK**.

   See Coefficent tab (page 187).

Delete a material

1. At the *Material Setup* screen, tap **Delete**.
2. To remove the material, tap **Remove**. A message displays prompting you to tap either:
   - **Remove** to remove the material.
   - **Cancel** to return to the *Material Setup* screen.

Alarms tab

Setting	Alarm triggers when...
High Alarm	The rate reaches the selected percentage above the target for longer than the delay setting
Low Alarm	The rate drops the below the target for longer than the delay setting for the selected percentage
Singulation Low	The singulation reaches a percentage lower than 100% for longer than the delay setting
Seeds When Off	This percentage of seeds is detected while the sections are off for longer than the delay setting
No Seeds When On	This percentage of seeds is not detected for longer than the delay setting
Blockage Sensitivity/Alarm	When less than this amount of material is sensed for the number of seconds given. When no pulses are sensed for this amount of time the alarm triggers.
Multiples Threshold	When two seeds fall within this percentage of seed spacing (this is considered a double). Lowering this number requires seeds to be closer together to be reported as a double.
Skips Threshold	If two seeds fall outside of this percentage of seed spacing (this is considered a). Raising this number requires seeds to be further apart to be a skip.
Averaging Sample Size	The number of seeds used to calculate the average. Increasing this amount makes the response slower but more stable.
Misplaced Seeds Threshold	If a seed falls outside this percentage of seed spacing then it is considered misplaced and reduces the spacing quality.

Operation tab

Setting	Explanation
Jump Start Speed	The speed to be used when the master switch on the Field-IQ system master switch box is put in the jump start position. This manual override option can be used to operate the system when the vehicle is stationary. Jump start is also used when GPS has become unavailable.
Jump Start Timeout	Time that Jumpstart speed will be active. A timeout setting for

Setting	Explanation
	the Jump Start Speed, which allows you to run the jump start for a specified amount of time. Auto control resumes if Jump Start Speed is exceeded by Ground Speed.
Shutoff Speed	This setting will shut the control system down when the vehicle reaches a minimum speed.
Minimum Override Speed	Setting used to hold the operating speed at a preset minimum to prevent the control system from operating out of a controllable range. Maintains the application rate when the implement's actual speed drops below the value entered. It is used to ensure consistent material flow during slow speeds.
Apply Latency to Boundary ***Note*** *– Only applies to fields that have a boundary.*	This setting is also applied when you exit an exclusion zone and return to the workable area of the field. • Yes: The system starts when needed to begin applying immediately when crossing a boundary. • No: The system starts when the boundary is reached and any mechanical delay could leave a gap between the boundary and where the product is applied. When GPS accuracy is low, this is the preferred selection.
Rate Snapping	Due to pump constraints, liquid flow generally is inconsistent with the information on the display. Enabling this setting gives you a more steady reading of the applied rate. If you are with in the allowable error, you will see the applied rate just show your target rate.

Coefficent tab

The material may have different calibrations for different locations. This means that you will need to make a different material for each location and name them in such a way (for example, Wheat Front Bin, Wheat Rear Bin) that you will know which location to use them in.

1. Enter the coefficient.
2. Tap **OK**.

Control setup

The first time you tap **Control Setup**, the *Control Setup* screen is blank and you can only add a location.

After you have added a location, you can select it from the Location list on the right-hand side of the screen to see the assigned modules.

Button	Tap to...
Add	Add and set up a new control location. This opens the *Control Details* screen, which contains the following tabs: • Material tab (page 188) • Layout (page 189) • Section Control tab (page 191) • Rate Control tab (page 195) • Row monitoring (page 197) • Sensor tab (page 198)
Edit	View or edit the details of an existing control location.
Delete	Delete an existing location. A message displays prompting you to tap either: • **Remove** to remove the material • **Cancel** to return to the *Control Setup* screen

Material tab

1. On the Material tab at the Available Materials list, select the material that will be set up in this location.

Setting	Explanation
Material Type	Select the type of material being applied: • Row Crop Seed • Liquid • Granular Seed • Granular Fertilizer • Anhydrous
Material Name	Name of the material
Material Units	Units to use with the selected material

Setting	Explanation
Seeds Per Pound	Number of seeds per pound
Target Rate 1	Preset volume that the implement supplies when the rate switch is in position 1. ***Note*** *– For liquid, granular fertilizer, NH3, and Granular seed, enter the desired amount of material that you would like to apply. For Row Crop seed, the target rate for row crop seed is entered as Ks/a. 1 Ks/a equals 1000 seeds per acre. When entering a target rate of 25500 into the display, type it as 25.5.*
Target Rate 2	Present volume that the implement supplies when the rate switch is in position 2. ***Note*** *– For liquid, granular fertilizer, NH3, and Granular seed, enter the desired amount of material that you would like to apply. For Row Crop seed, the target rate for row crop seed is entered as Ks/a. 1 Ks/a equals 1000 seeds per acre. When entering a target rate of 25500 into the display, type it as 25.5.*
Rate Increment	This setting adjusts the increment that the target rate will adjust by when in rate 1 or 2.
Manual Rate Increment	Controls the aggressiveness of the rate adjustment switch when in manual rate. • If the valve is over active when in manual rate you need to lower the manual rate increment. • If the valve is slow to respond when in manual rate you need to increase the manual rate increment.
Minimum Rate	Sets the minimum rate increment.
Maximum Rate	Sets the maximum rate increment. ***Note*** *– If you don't want the system to be capable of applying more than 100 units, set the maximum rate to 100 units.*

2. If no materials are listed, create a material that you can assign. See Material setup (page 185).

   Note *– You can also assign the correct material later using the Material Assignment option, see Material assignment (page 353).*

3. Tap **Next** to go to the Layout (page 189).

Layout

At the Layout tab, enter information about the implement that will be used to apply the material.

Setting	Explanation
Location Name	Add a name to the Control Location, for example, Hoppers, Front Bin, Rear Bin, Left Saddle Tanks.

Bin/Tank Setup	The system tracks how much material is left in the bin/tank, and provides a warning when the bin/tank needs to be refilled. Adjust the settings for:
	• Status:
	  • On: The system tracks the bin/tank level and provide warnings.
	  • Off: The system will not track the bin/tank level or provide warnings.
	• Density: (Granular and granulated material only.) Used in system setup and calibration to ensure accuracy in applying product. When changing material this setting must be updated.
	• Capacity Units: Select Default Units or Bushels. Default units will vary according to the type of material that is being applied.
	• Bin Capacity: The amount the tank/bin holds when full.
	Note *– Markings on tank/bin may not be accurate.*
	• Current Volume: Current volume of the product in the tank.
	• Partial Refill: The amount of material that will be added to the bin/tank during a partial refill.
	• Warning Level: Setting that triggers a low bin warning. The level at which a warning displays on the screen when your bin/tank reaches a set threshold.
	• Spinner Pulses Per Revolution: Enter the number of magnetic pick up points per revolution of the spinner.
	• Refill Tank/Bin: Refills the tank/bin to capacity.
	• Partial Refill Tank/Bin: Refills the tank/bin to the Partial Refill amount.

Row Offset Setup	Provides additional tuning by detailing where the material will be applied in relation to the vehicle. Increase coverage accuracy by selecting one or two offsets. Row offsets are measured from the Application Offset value entered in the Measurements tab of the *Implement Configuration* wizard. • Number of row offsets: Use 1 row offset when coverage is applied at a single location. Use two row offsets when planting singulated seed with staggered implements. • Row Offset (1 row offset): Enter the distance between the Application

Setting	Explanation
	Offset and the row. • Rear Row Offset (2 row offset): Enter the distance between the Application Offset and the rear row. • Front Row Offset (2 row offset): Enter the distance between the Application Offset and the front row.
Material Controlled By	You are controlling the material with: • Switch Boxes • On Screen

Section Control tab

With section control, you can avoid double coverage and eliminating wasted inputs using automatic or manual section control. Section control:

- Automatically control up to 48 rows individually
- Enables you to see where you have been and what you have done with overlap detection
- Eliminates overlap by adding Tru Count Air Clutches® and Tru Count LiquiBlock™ valves

At the Section Control tab, you can set up section control as:

- Rate as Section: To use rate control drives as section shutoffs
- Material linking: To link primary and secondary materials
- Automatic Section Control: Automatic section control with various section control devices

Rate as Section

The Field-IQ system can use the rate control drives as section shutoffs. For example, when going into a nonproductive or covered area the rate control drives will be commanded to zero rate.

1. To set up rate as sections, at the Section Control tab, complete these settings.

Setting	Explanation
Section Control	Select Rate as Section.
Section Control	Tap **Setup** to adjust latency and overlap values.

2. Select the Rate Control tab and then set up rate control.

Material linking

The Field-IQ system can link primary and secondary materials, where the secondary material uses the output of the primary material. For example, LiquiBlock valves can be linked to use the output of Tru Count Air Clutch systems.

When planting, seeding, or strip-tilling, you can link the following together:

- Liquid
- Granular seed
- Granular fertilizer

Note *– Anhydrous cannot be linked.*

When the system is in diagnostics mode:

- The secondary material is not functional.
- You can only operate a linked material when you also open the sections of the primary material.

1. To link materials, at the Section Control tab, complete these settings.

Setting	Explanation
Section Control	Select Link to Material.
Linked Material	Select the primary material you want to link to.

2. Select the *Rate Control* tab and then set up rate control.

For more information, see the sections for each type below.

Automatic Section Control

The Field-IQ system can perform automatic section control using:

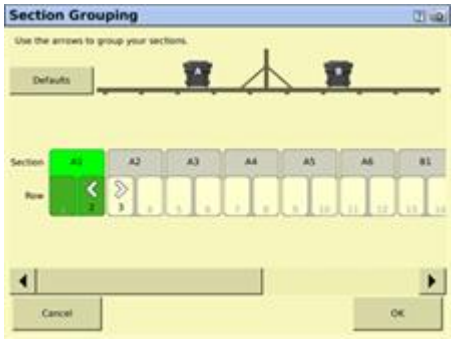
- Air clutch (such as Tru Count Air Clutch) or electric clutch: Used for TC and John Deere row command clutches that require inverted switching. (Signal to shut row off)
- Boom valves: Used for 3 wire boom valves and 2 wire solenoid valves that require a 12v signal to open.
- LiquiBlock valves (such as Tru Count LiquiBlock valves): Used for Liquiblock valves that require inverted switching.
- Various section control devices

1. At the Field-IQ Setup screen on the Section Control tab, for:
   a. Section Control: Select On.
   b. Section Control Module Location: Tap **Setup**. The *Section Control Module Setup* screen displays.
2. Complete the settings for:
   - Number of Modules: The total number of modules that will be used on the current control location.
   - Module: Assign the serial numbers of the modules to their location on the current control location.

     Note *– Sections start from left to right in their numbering. This means that Section 1 is on the far left and numbers increase to the right.*
   - Number of Sections: The number of sections physically wired into the selected module serial number.
3. If you have a row crop, tap Section Grouping. Otherwise tap Section Widths.
4. Set up the section widths.

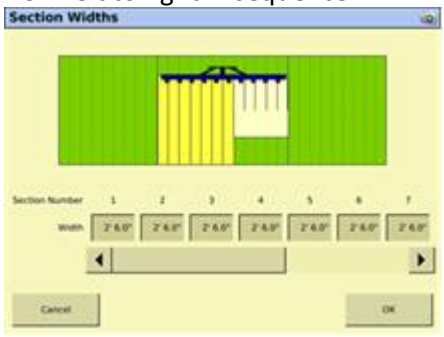
   Note *– Both of these setups allow you to set the section widths. Section Grouping does it by grouping rows together in a section and Sections Widths allows you to enter an actual measurement.*

   a. For section grouping, at the Section Grouping screen: Complete each row from the left and to right in sequence until all the rows are grouped correctly and then tap **OK**.



   For section widths, at the Section Widths screen: Enter the section width for each section from left to right in sequence.

   b.

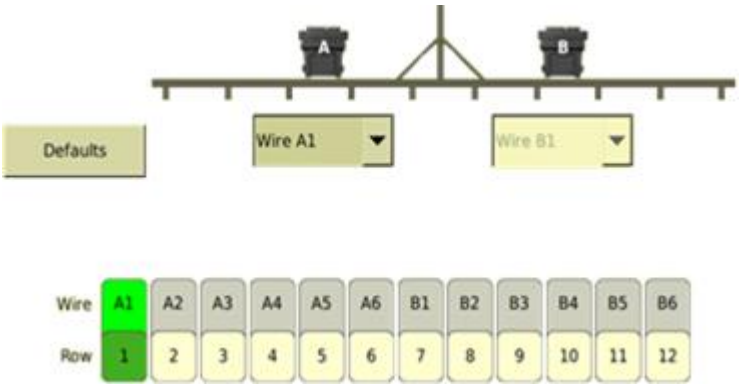


When you are finished, tap OK.

5. At the *Section Control Module Setup* screen, tap **Advanced Wire Assignment**.

   Note *– This button is only available for specific cases, so may not be visible.*

   Assign the rows to the correct module and wire location. To assign a wire ID to a row, tap the module icon, select the number of the wire you want to assign from the drop-down list. and then tap on the row to assign that module and wire. It is recommended that you work from left to right:



Latency

Setting	Explanation
On Latency	By default, this is set to 0.0 seconds. Use this setting unless you are experiencing a long response time from your clutch or valve (this can happen on larger systems). In this case, increase the On Latency value to compensate the delay, and the system will turn on in advance.
Off Latency	By default, this is set to 0.0 seconds. Use this setting unless you are experiencing a long response time from your clutch or valve (this can happen on larger systems). In this case, increase the Off Latency value to compensate for the delay, and the system will turn off after the set number of seconds.

Overlap

Setting	Explanation
Start Overlap	Distance of intentional swath overlap when entering a previously applied area. The higher the number, the greater the overlapped area.
End Overlap	Distance of intentional swath overlap when exiting a previously applied area. The higher the number, the greater the overlapped area.

Setting	Explanation
Coverage Switching Overlap	Percentage of the section width for intentional swath overlap. The higher the number, the greater the overlapped area before the section is turned off.
Boundary Switching Overlap	Percentage of the section width for intentional overlap of a boundary. The higher the number, the greater the overlapped area into the boundary area.

Rate Control tab

At the Rate Control tab, adjust the settings.

Setting	Explanation
Rate Control	Select ON to have the Field-IQ system operate a rate control component. The system sets the target rate. Select OFF for no rate control. Section switching only.
Rate Control Module Location	Tap **Setup** to configure the rate control module(s), their location on the implement, and the width they will control.
Drive Setup	Tap to set up the drive. Complete the settings on these tabs: • Valve Setup • Feedback Setup • Advanced

Valve Setup tab

Setting	Explanation
Valve Type	• Servo: 2-wire standard servo valve that turns a ball or butterfly valve to adjust product flow • Fast Servo: 4-wire servo valve motor that turns a ball or butterfly valve to adjust product flow • PWM: 2-wire PWM valve. An electric solenoid valve that adjust hydraulic flow to a motor. The valve adjusts application rate indirectly. • Pump Servo: An electric solenoid valve that adjust hydraulic flow to a motor. The valve adjusts application rate indirectly. • Linear Actuator: A valve that creates a linear motion (as opposed to a rotary motion) • Electric over Hydraulic: A valve that uses electric current to control the hydraulic valve output • Hardi % Bypass: • Linear actuator: • Electric over Hydraulic: • Ground drive:
Plumbing	• Inline: Valve is in the solution line going to the boom. The valve opens to increase the application rate. • Bypass: Valve is in the return-to-tank line. The valve closes to increase the application rate.
Valve Behavior On Sections Closed	• Close: When all sections are off, the control valve returns to the closed position. • Lock in Last Position: When all sections are off, the control valve remains in the last position. This setting allows the system to return to the target rate faster. The valve will remain locked in the position it was in when the boom sections were closed. • Lock in Minimum: Used with a PWM type valve. The valve will lock into a minimum position that is configured in setup.
Auxiliary Valve	• Master: Valve closes when the system is turned off. • Dump: Valve opens to dump flow-to-return line when the system is turned off.

Setting	Explanation
Pump Disarming Switch	• Enable: Select this option if you have a pump disarming switch installed. • Disable: Select this option if you do not have a pump disarming switch installed.

Feedback Setup tab

Setting	Explanation
Shaft Encoder Constant	Pulses per revolution.
Gear Ratio	Actual ratio of the application rate sensor to the seed meter shaft RPM. This is the number of revolutions the application rate sensor turns for each revolution of the seed meter. The Gear ratio allows the system to properly figure the meter RPM. • The gear Ratio should be calculated from the Encoder to the metering point of the material. • Rawson gear ratio should be figured from the motor to the metering point of the material If the gear ratio is figured incorrectly the system may over or under apply even though it is showing the correct rate on the screen. You may also have issues in the drive calibration screen.
Gear Ratio	Use the calculator (tap **Gear Ratio Calculator**) to determine your gear ratio.
Seeds Per Disk	The number of seed openings per disk plate.

Row monitoring

Setting	Explanation
Row Monitoring	• Disabled: Row monitoring is turned off. • Blockage: Select when using an air seeder or when applying granular material. • Seed Count: Select for precision seeding.
Setup	• Row Sensor Enable: Turn individual row sensors on or off. • Row Sensor Wiring: Select which wire each row sensor is wired to.

Sensor tab

At the Sensor tab, you can add alarm functionality to a sensor. You can also access the *Sensor Setup* screen, where you can add, edit, or delete sensors.

Setting	Explanation
Sensor Type	The required sensor for which you want to create an alarm.
Name	Displays after you have selected the sensor type. You can enter a name for the sensor.
Alarm	Enabled: Alarm is enabled Disabled: There is no alarm
Warn if below	If less than this threshold and longer than the delay time, the alarm will display.
Warn if above	If more than this threshold and longer than the delay time, the alarm will display.
Warn after	Delay time for the threshold values: • Warn if below • Warn if above
Sensor Setup	Tap to access the *Sensor Setup* screen.

Sensor Setup screen

At the *Sensor Setup* screen, you can add, edit or remove a sensor.

When adding or editing a sensor, enter the following information.

Setting	Explanation
Sensor Type	• Air pressure/vacuum • Liquid pressure • NH3 pressure • Bin level • RPM • Gate Height
Name	Enter a name for the sensor
Sensor Setup	Field-IQ module: The Field-IQ system module that is controlling this sensor.

Setting	Explanation
	Input location: Which wire is controlling the sensor. (Not required for gate height.)
Alarm	Alarm settings

Equipment calibration for Field-IQ

Calibrate the equipment for your setup:

- Anhydrous calibration (page 201)
- Air Seeder calibration (page 200)
- Planter calibration (page 203)
- Sprayer calibration (page 207)
- Spreader calibration (page 207)

Air Seeder calibration

WARNING – Moving parts during this operation. Ensure the implement is safe to operate.

To calibrate an air seeder calibrate the implement lift switch, then the modules.

For a spreader or seeder: Minimum and maximum motor RPM are used to keep the motor within the manufactures recommended operating range. Rawson specs are 150 and 500 RPM.

Implement lift switch calibration

1. At the *Field-IQ Calibration* screen, select Implement Lift.
2. Raise the implement and then tap **Next**.
3. Lower the implement and then tap **Next**.
4. Tap **OK** to return to the Field-IQ *Calibration* screen.

Modules calibration

Calibrate the modules to ensure that your system performs at the level you require.

Note *– If you have an implement lift switch, calibrate it first.*

The Field-system *Calibrate* option only displays on the *Configuration* screen if you have at least one Field-IQ system Rawson control module or Rate control module set up to control the rate.

1. At the *Configuration* screen, select Field-IQ and then tap **Calibrate**.
2. At the *Field-IQ Calibration* screen, select the operation listed under the module that you want to calibrate. The message Not calibrated displays at the end of the modules that need calibration.

   Note *– Calibration screens will vary slightly if you are using a linear actuator.*

Note *– Before priming the system, the Automatic / Manual Switch on the master switch box must be in the manual position.*

3. Tap **Drive Calibration** and then tap **OK**. The *Drive Calibration* screen displays. Enter the appropriate settings.

Tab	Explanation
Drive Limits	Enter the minimum and maximum flow values.
Auto-Tuning	Moving parts during this operation. Ensure that the implement is safe to operate. Follow the on-screen instructions to auto-tune the system. Do not perform the auto-tuning function if you have loaded a preset configuration file. Use the predefined configuration settings appropriate for your vehicle.
Drive Settings	Turn the master switch on and vary the rates. Adjust values if needed.
Info	Shows the results and drive limits of your calibration.

4. Select Flow Calibration and then tap **OK**. The *Flow Calibration* screen displays.

Anhydrous calibration

WARNING – NH3 is an irritant and corrosive to the skin, eyes, respiratory tract and mucous membranes, and is dangerous if not handled properly. It may cause severe burns to the eyes, lungs, and skin. Skin, and respiratory-related diseases could be aggravated by exposure. It is recommended that protective gloves, boots, slicker and/or pants and jacket, and chemical-splash goggles that are impervious to anhydrous ammonia are worn at all times.

WARNING – Anhydrous valve and flow calibrations require the vehicle and implement to be moving and the implement must be in the ground (the implement lift switch must be down). Take all necessary precautions to ensure user safety. Failure to do so may result in serious injury or death.

To calibrate anhydrous, first calibrate the implement lift switch. Then calibrate the modules to ensure your system performs at the level you require.

Implement lift switch calibration

1. At the *Field-IQ Calibration* screen, select Implement Lift.
2. Raise the implement and then tap **Next**.
3. Lower the implement and then tap **Next**.
4. Tap **OK** to return to the Field-IQ *Calibration* screen.

Module drive calibration

The anhydrous valve calibration requires the vehicle and implement to be moving and the implement must be in the ground (the implement lift switch must be down). Take all necessary precautions to ensure user safety. Failure to do so may result in serious injury or death.

The Field-IQ system Calibrate option only displays on the *Configuration* screen if you have at least one Field-IQ system Rawson control module or Rate control module set up to control the rate.

1. At the *Configuration* screen, select Field-IQ and tap **Calibrate**.
2. At the *Field-IQ Calibration* screen, select the operation under the Module that you would like to calibrate. The message "Not calibrated" displays at the end of the modules that need calibration.

   Note *– If you have an implement lift switch, calibrate it first.*
3. Select Drive Calibration and tap **OK**. The *Drive Calibration* screen displays.
4. At the Drive Limits tab, enter the minimum and maximum flow valves and tap Next.
5. At the Drive Settings tab, turn the master switch on and vary the rates. Adjust the values if needed. Enter the values for:
   - Allowable Error
   - Integral Gain
   - Minimum Response
6. Tap **Next** and enter the following values for:
   - Allowable Error
   - Gain
   - Minimum Response

   Note *– For information about the appropriate values for your sprayer, refer to the support note Field-IQ crop Input Control System: For Sprayers and Spreaders.*

Module flow calibration

1. At the *Field-IQ Calibration* screen, select Flow Calibration and tap **OK**.
2. At the *Rate and Section Control Flow Calibration* screen, enter values for:
   - Flow Meter type
   - Flow Meter Calibration
   - Minimum Flow
3. Tap **Run Calibration** and follow the on-screen instructions.

Planter calibration

The calibration process for a planter includes:

- Implement lift switch calibration (page 203)
- Rawson modules calibration (page 203)
- Hydraulic test (page 204)
- PWM valves calibration (page 205)

Implement lift switch calibration

WARNING – Moving parts during this operation. Make sure that the implement is safe to operate.

1. At the *Field-IQ Calibration* screen, select Implement Lift.
2. Raise the implement and then tap **Next**.
3. Lower the implement and then tap **Next**.
4. Tap **OK** to return to the *Field-IQ Calibration* screen.

Rawson modules calibration

Note *– If you have an implement lift switch, calibrate it first.*

Calibrate the modules to ensure that your system performs at the level you require.

Note *– You must have at least one Field-IQ system Rawson control module or Rate control module set up to control the rate before the Field-IQ* **Calibrate** *button will display on the Configuration screen.*

1. At the *Configuration* screen, select Field-IQ and tap **Calibrate**. The *Field-IQ Calibration* screen displays.
2. Select the first module that you want to calibrate. The *Planter Calibration* screen displays.

   Note *– If a Rawson module was configured, the correct calibration is selected automatically.*
3. Complete the settings.

Setting	Explanation
Seeds Per Disk	The number of seed openings per disk plate
Gear Ratio	Tap **Calculate** to determine the gear ratio. Allows the system to properly figure the meter RPM. The number of revolutions that the application rate sensor turns for each revolution of the seed meter.

Setting	Explanation
	Calculate the gear ratio from the encoder to the metering point of the material. Calculate the Rawson gear ratio from the motor to the metering point of the material. ***Note*** *– If the gear ratio is figured incorrectly, the system may over or under apply, even if it is showing the correct rate on the screen. You may also have issues in the drive calibration screen.*
Calibration Constant	A calculated value the system determines during calibration. To begin, leave the value at 1.000. After the calibration test, the system may adjust this value.

4. Place a clean empty container under the rows that contain seeds to capture the seeds dispensed during the calibration.

WARNING – Moving parts during this operation. Ensure the implement is safe to operate.

5. Tap **Test**.
6. The system asks if you would like to prime the system. Tap **Yes**. To to ensure that the seed disk is full, the system turns the seed disks one revolution.
7. Turn on the master switch to prime the system and then when prompted on-screen, turn off the master switch.
8. For Number of Seed Meter Revolutions, enter a value and tap **Start**. The higher the number of revolutions the more accurate the calibration. Five to 10 revolutions is recommended.
9. Follow the on-screen prompts of operating the master switch. After the system turns the specified number of revolutions, enter the number of seeds dispensed per row and then tap **Continue**.
10. The next screen shows the minimum and maximum speeds for the target rate specified. Tap **OK** and then either press **Test** to repeat the calibration or tap **OK** to continue.
11. Select the Limits tab to view a listing of the limits that are set.
12. Tap **OK**.
13. Repeat the previous steps for other Rawson Control Modules that need calibration.

Hydraulic test

The purpose of this test is to exercise the hydraulics to establish whether there is sufficient oil flow to run the system. The Rawson hydraulic test is used to make sure the drive will turn. After entering a desired RPM the master switch is turned on and the drive should begin to turn.

If the drive does not turn, check all electrical connections. If the motor is plugged in properly, it will make a hissing or whining noise.

1. Check that there is hydraulic flow to the Rawson.
2. At the *Field-IQ Calibration* screen, tap **Hydraulic Test**.

WARNING – Moving parts during this operation. Ensure the implement is safe to operate.

3. Tap **Next**.
4. Enter the initial motor RPM. The default setting is 300. It is recommended that you test the motor RPM at 100 to ensure that the drive runs smoothly at slow speeds.
5. Tap **Start**. The next screen provides the status of each motor:
   - No Error: The test was successful.
   - Motor Stalled: The motors did not have sufficient oil flow. Ensure the correct orifice size is installed for each motor. For more information, refer to the *Rawson System Installation Instructions*.
   - Disconnected: The Rawson Control Module cannot communicate with the motor.
6. Tap **Stop** to return to the *Field-IQ Calibration* screen.

PWM valves calibration

Drive Calibration

1. At the *Field-IQ Calibration* screen, select Drive Calibration. The *Field-IQ Drive Calibration* screen displays.
2. On the Drive Limits tab, enter the values for:
   - Minimum Seed Disk RPM
   - Maximum Seed Disk RPM

   Tap **Next**.
3. On the Auto Tuning tab, follow the instructions to auto tune the system.

   Note *– Do not perform the auto tuning function if you have loaded a preset configuration file. Use the predefined configuration settings appropriate for your vehicle.*

WARNING – Moving parts during this operation. Ensure the implement is safe to operate.

   During the auto tuning process the system tries to control the drive with in the specified RPM limits.

   If the calibration fails, the drive may have not been able to meet the limits you entered on the Drive Limits tab.

   For a liquid system, it may be helpful to remove all orifices or nozzles to let the system flow freely.

4. When the auto tuning is finished, tap **Next**.
5. On the Drive Settings tab, turn the master switch on and vary the rates. Then adjust the values on this tab, if necessary.
6. Tap **Next**. On the Info tab, the results and drive limits of the calibration are listed. This screen is used to show the applicators operating range. If the speeds that are displayed are not logical, there is a setting issue. You may also need to perform a catch test for these numbers to be accurate.

Flow Calibration

WARNING – During flow calibration, the machine will become operational. Take all necessary precautions to ensure user safety. Failure to do so may result in serious injury or death.

Flow calibration is used to check the accuracy of the:

- Gear ratio (if applicable)
- Gate settings (if applicable)
- App rate sensor

WARNING – Moving parts during this operation. Ensure the implement is safe to operate.

This is done by performing a catch test.

1. At the *Field-IQ Calibration* screen, select Flow Calibration under the valve you want to caibrate. The *Planter Calibration* screen displays.
2. On the Calibrate tab, complete the settings.

Setting	Explanation
Seeds Per Disk	The number of seed openings per disk plate.
Shaft Encoder Constant	Pulses per revolution.
Calibration Constant	A calculated value that the system determines during calibration. This field allows you to adjust for inconsistencies in the seed meters. To start out, leave the value at 1.000. After the calibration test, the system may adjust this number.

3. Tap **Test** and follow the instructions to test the settings you entered.
4. On the Limits tab, you can view an overview of the limits that are set.

Sprayer calibration

WARNING – Moving parts during this operation. Ensure the implement is safe to operate.

To calibrate a sprayer calibrate the implement lift switch, then the modules.

Implement lift switch calibration

1. From the *Field-IQ Calibration* screen, select Implement Lift.
2. Raise the implement and then tap **Next**.
3. Lower the implement and then tap **Next**.
4. Tap **OK** to return to the *Field-IQ Calibration* screen.

Spraying modules calibration

Calibrate the modules to ensure that your system performs at the level you require.

The option to calibrate the Field-IQ system only displays on the *Configuration* screen if you have at least one Field-IQ system Rate and Section control module installed.

1. At the *Configuration* screen, select Field-IQ and then tap **Calibrate**.
2. At the *Field-IQ Calibration* screen, select the Rate and Section Control module you want to calibrate.

Note *– If you have an implement lift switch, calibrate it first. See above.*

Spreader calibration

To calibrate a spreader, first calibrate the implement lift switch. Then calibrate the modules to ensure your system performs at the level you require.

1. Implement lift switch calibration
2. At the *Field-IQ Calibration* screen, select the Implement Lift option.
3. Raise the implement and then tap **Next**.
4. Lower the implement and then tap **Next**.
5. Tap **OK** to return to the Field-IQ *Calibration* screen.

Rawson modules calibration

The Field-IQ system *Calibrate* option only displays on the *Configuration* screen if you have at least one Field-IQ system Rawson control module or rate control module set up to control the rate.

Note *– If you have an implement lift switch, calibrate it first.*

1. At the *Configuration* screen, select Field-IQ and then tap **Calibrate**.
2. At the *Field-IQ Calibration* screen, select the module you want to calibrate.
3. Select the first module to calibrate. The *Planter Calibration* screen displays.

   Note *– If a Rawson module was configured, the correct calibration is selected automatically.*

Setting	Explanation
Gear Ratio	Specifies the actual ratio from the applicaiton rate sensor to the seed meter shaft RPM. This is the number of revolutions the application rate sensor turns for each revolution of the seed meter.
Gear Ratio Calculator	Use the calculator to determine your gear ratio.
Calibration Constant	A calculated value that the system determines during calibration. This field allows you to adjust for inconsistencies in the seed meters. To start out, leave the value at 1.000. After the calibration test, the system may adjust this number.

4. Place a clean empty container under the rows that contain seeds to capture the seeds dispensed during the calibration.

   WARNING – Moving parts during this operation. Ensure the implement is safe to operate.

5. Tap **Test**.
6. The system asks if you would like to prime the system. Tap **Yes**. To to ensure that the seed disk is full, the system turns the seed disks one revolution.
7. Turn on the master switch to prime the system and then when prompted on-screen, turn off the master switch.
8. In the Number of Seed Meter Revolutions entry box, enter a value and then tap **Start**. The higher the number of revolutions the more accurate the calibration. Five to 10 revolutions is recommended.
9. Follow the on-screen prompts of operating the master switch. After the system turns the specified number of revolutions, enter the number of seeds dispensed per row and then tap **Continue**.
10. The next screen shows the minimum and maximum speeds for the target rate specified. Tap **OK** and then either press **Test** to repeat the calibration or tap **OK** to continue.
11. Tap the Limits tab to show an overview of the limits that are set for Target Rate 1, Target Rate 2 and Jump Start.
12. Tap **OK**.
13. Repeat steps 1 through 10 for other Rawson Control Modules that need calibration.

Hydraulics test

The purpose of the hydraulics test is to exercise the hydraulics to establish whether there is sufficient oil flow to run the system.

1. At the *Field-IQ Calibration* screen tap **Hydraulic Test**.

WARNING – Moving parts during this operation. Make sure that the implement is safe to operate.

2. Tap **Next**.
3. Enter the initial motor RPM. The default setting is 300. It is recommended that you test the motor RPM at 100 to ensure that the drive runs smoothly at slow speeds.
4. Tap **Start**. The next screen provides the status of each motor.

Status	Explanation
No Error	The test was successful.
Motor Stalled	The motors did not have sufficient oil flow; ensure the correct orifice size is installed for each motor. For more information, refer to the *Rawson System Installation Instructions*.
Disconnected	The Rawson Control Module cannot communicate with the motor.

5. Tap **Stop** to return to the *Field-IQ Calibration* screen.

PWM valves calibration

Drive calibration

From the *Field-IQ Calibration* screen, select Drive Calibration under the valve you want to calibrate. Enter the appropriate settings on each tab.

Tab	Explanation
Drive Limits	Enter the minimum and maximum flow values.
Auto-Tuning	Moving parts during this operation. Ensure that the implement is safe to operate. Follow the on-screen instructions to auto-tune the system. Do not perform the auto-tuning function if you have loaded a preset configuration file. Use the predefined configuration settings appropriate for your vehicle.
Drive Settings	Turn the master switch on and vary the rates. Adjust values if needed.
Info	Shows the results and drive limits of your calibration.

Flow calibration

WARNING – During flow calibration, the machine will become operational. Take all necessary precautions to ensure user safety. Failure to do so may result in serious injury or death.

The Field-IQ system *Calibration* option only displays on the *Configuration* screen if you have at least one Field-IQ system Rate and Section control module installed.

1. At the *Configuration* screen, select Field-IQ and then tap **Calibrate**.
2. At the *Field-IQ Calibration* screen, select the Rate and Section Control Module to be calibrated. (The message Not calibrated displays at the end of the modules that need calibration.) The *Field-IQ Calibration* screen displays that includes the serial number of the rate and section control module you just selected.
3. Select Flow Calibration. The *Rate and Section Controller Valve Calibration* screen displays.
4. Select the Control tab and complete the settings for:
   - Allowable Error
   - Gain
   - Minimum Response

   Note *– For information about the appropriate values for your sprayer, see the Support Note - Field-IQ Crop Input Control System: For Sprayers and Spreaders.*
5. Tap **OK** to return to the *Field-IQ Calibration* screen.
6. Select Flow Calibration. The *Granular Calibration* screen displays.
7. At the Calibrate tab, complete the settings.

Setting	Explanation
Gate Height Setting	Current height of the gate opening. If you entered a gate height measurement during setup, you must enter a measurement here.
Staff Encoder Constant	

8. Tap **Calculate** to calibrate the constant. The *Calibration Constant Calculator* screen displays.
9. Complete the settings.

Setting	Explanation
Gate Width	Width of the gate opening
Drag Chain Distance Per Rev	The length of the drag chain per turn of the drag shaft.

Setting	Explanation
	To figure the drag chain length, you can either: • Multiply the diameter of the drag shaft by 3.14. • Mark the belt and measure the distance the mark moved after 1 revolution of the drag shaft. If these numbers are not correct, you will have issues calibrating the spreader. If any of these settings physically change in the implement, they need to be adjusted in the FM-1000 integrated display to maintain accuracy.

The system calculates the calibration constant. This value represents the liters of material dispensed from the spreader per revolution of the drag shaft assuming the gate height is 1 meter. The actual gate height is factored in later. The FM-1000 integrated display will automatically come up with this value.

10. Tap **OK** to return to the *Granular Calibration* screen.
11. Place a clean empty container under the spreader to capture the material dispensed during the calibration, and then tap **Calibrate**. The *Granular Calibration* screen displays.

WARNING – Moving parts during this operation. Ensure the implement is safe to operate.

12. Complete the settings.

Setting	Explanation
Amount of Material to be Dispensed	The amount to be dispensed during the calibration.
Target Rate	
Target Calibration	

13. To begin calibration, tap **Start** and follow the on-screen instructions.
14. Select the Info tab to view the system's operational limits (based on the RPM limits, target rates, and application width).
15. Tap **OK**.

Gate height calibration

Note – *As part of calibrating the gate height, you will enter the current height of the gate, then change the gate height and enter that height.*

1. At the *Field-IQ Calibration* screen, tap the gate height you want to calibrate. The *Gate Height Calibration* screen displays
2. At the Enabled list, select Yes and tap **Next**.
3. In the Actual Gate Height entry box, enter the actual height of the gate.
4. Adjust the gate to a different height and tap **Next**.
5. In the Actual Gate Height entry box, enter the actual height of the gate that you adjusted it to. Tap **Next**. The system returns you to the *Field-IQ Calibration* screen.

Upgrade Field-IQ system firmware

You can use the display to upgrade the Field-IQ system firmware components:

- Master Switch Box
- 12 Section Switch Box
- Rate and Section Control Module
- Seed Monitoring Module
- Section Control Module
- Rate Control Module
- Rawson Control Module

Upgrade steps

To upgrade a component's firmware:

1. Transfer the new firmware file from www.trimble.com to your office computer.
2. Connect a USB drive to your office computer.
3. Copy the firmware upgrade file to the Firmware folder on the USB drive.
4. Insert the USB drive into a USB socket on the display.
5. Press the power button on the rear of the display to turn on the display. Wait for the *Home* screen to display.
6. Tap **Upgrade**. The *Firmware Upgrade* screen displays.
7. Tap the appropriate hardware on the Hardware list.
8. Tap the appropriate feature from the Firmware list. Any available firmware upgrade files display in the upper right list.
9. Tap the appropriate firmware file. The display shows the upgrade progress.
10. After the upgrade is complete, tap **OK**. The system restarts. The component's firmware is now updated.

CHAPTER 10

GreenSeeker setup

In this chapter:

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Care and maintenance **216**

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GreenSeeker sensorsshines a calibrated light wave spectrum to measure the returned reflective light spectrum from plants, and analyzes the data to determine the plants' needs for nitrogen

GreenSeeker functionality

As you travel the field, in real-time the GreenSeeker RT200 system:

- Sensors emit light at two specific wavelengths to measure the light reflected by plants.
- Analyzes the reflected light and determines the nitrogen level (NDVI - normalized difference vegetation index) of the plants below
- Sends the data to the FM-1000 integrated display

The display sends the correct application rates to either:

- The applicator's rate controller (using Serial Rate Control)
- The Field-IQ system

The required amount of fertilizer is applied as you pass over the crop.

As materials are applied, the system logs the:

- NDVI
- Target rate
- Applied rate

Note *– Some rate controllers connected via serial cable to the display do not respond with an 'As Applied' value.*

For operational information, see GreenSeeker operation (page 368).

Care and maintenance

To maintain the high performance of your GreenSeeker RT200 variable rate application and mapping system:

- Each day or during applicator re-fill, check the GreenSeeker sensor detector and light source windows for dust and dirt, and wipe clean with a soft rag.
- Do not leave the GreenSeeker system outdoors during extreme weather conditions. Wide temperature variations are hard on electronics and fluid seals, and may reduce the operating life of the system.
- DO NOT store a GreenSeeker system with the sensors facing upward. Doing so may allow water to collect around the windows and gaskets, causing seal failures in those areas. Also direct sunlight can in some cases focus enough energy into the sensor to damage the detector.

Note *– There are no field serviceable components of the electronic system; do not attempt any field repair of a malfunctioning interface module or sensors. If you experience operating problems, contact your local dealer.*

Field preparations for nitrogen application

Note *– The following instructions apply to the most common nitrogen applications. Check algorithms for specific instructions. For updated specific algorithm instructions, visit* www.GreenSeeker.com.

Before you can use the GreenSeeker applicator to apply nitrogen across a field, before or shortly after planting you must establish a nitrogen rich reference strip (NRS) or "calibration" area. The rest of the field is referred to as the Non-Reference (Non-Ref) portion (or as the N-limited area or farmer practice region).

The NRS reference strip is used to determine the:

- Amount of nitrogen being made available to the plant by the environment (such as mineralization)
- Current year's expected maximum yield potential and response to additional nitrogen

An ideal NRS runs the length of the field, but must be at least 400 feet long.

1. Establish the NRS in a representative reference portion of the field (in other words, not in high spot or low spot). Use a permanent land marker or temporary marker to ensure that the NRS can easily be found later in the season. You may also want to establish the location of the NRS by noting it as an A-B line or flag on the screen.

   The rate of nitrogen necessary to establish a NRS:

   - Is crop and region dependent
   - Should be the highest rate necessary to satisfy crop needs throughout the growing season
2. Use the sensor mounted booms of the RT200 system with RT Commander or the GreenSeeker Hand Held sensor.

   If past practice was a 100% pre-plant application of nitrogen, decrease pre-plant nitrogen application rate of the field to a level at least half of previous total nitrogen applied during non-GreenSeeker management practice.

Crop	Explanation
Spring or winter wheat	If application rate has historically been 100 lbs N/acre, decrease the rate to 50 lbs nitrogen per acre. ***Note*** *– Sandy soil type or heavy rainfall may require additional N application to maintain the NRS as a non-limiting reference area.*
Corn	If application rates have historically been 200 lbs nitrogen per acre decrease to 75 to 125 lbs N/acre. ***Note*** *– Sandy soil type or heavy rainfall may require additional N application to maintain the NRS as a non-limiting reference area.*

For best results, use the RT200 to "read" the NRS and apply N at growth stages dependent upon the crop algorithm used. For most supplied algorithms this is typically:

- Wheat: Feekes growth stage 4-6
- Corn: V8-V12

For updated specific algorithm instructions, see www.GreenSeeker.com. Plant coverage should be at least 50% for the sensors to accurately determine NDVI for topdressing (or sidedressing).

To collect sensor readings, pass the boom mounted sensor (or handheld sensor) over the crop at 32 — 48" above the canopy. Sense a large area of the NRS and nonreference portion of the field to accurately determine their respective NDVI values.

3. Apply an applicators width swath of N. The rate of N applied should be high enough to satisfy crop N needs in a good year.
4. Enter the values into GreenSeeker on the FM-1000 integrated display:
   - Automatically with the boom mounted sensors
   - Manually with the GreenSeeker handheld
5. If the response is variable across the field, select an area where the difference between the reference and the non-reference areas are most apparent. This assures that the algorithm will determine a rate that utilizes the highest yield potential prediction and maximum response to N for that year.

   To estimate yield potential, most algorithms utilize an environmental factor (Growing Degree Days or Days From Planting), which takes into account the weather and length of time that has passed since planting.

   Different GDD variations are used for different crops. You must know the planting date and sensing date to obtain the GDD value. Regional values for GDD can be found on the internet. Visit http://www.ntechindustries.com/software, and browse to the *Where to Find GDD Information* link.

Field setup

To prepare a reference area, do the following:

1. Make certain to use a permanent land marker or temporary marker to ensure that the NRS can easily be found later in the season. You may also want to establish the location of the NRS by noting it as an A-B line or flag on the FM-1000 integrated display.

   The ideal NRS would run the length of the field, but it should at least be 400 feet long.
2. At appropriate crop growth stage, take readings of the NRS and an adjacent part of the field yet to be fertilized. For most supplied algorithms the following is typical:
   - Wheat: Feekes growth stage 4-6
   - Corn: V8-V12.

3. Find the area where the nitrogen rich strip is most apparent in comparison to the rest of the field (this indicates greatest potential for the crop).
4. Take sensor readings with RT200 or Hand Held sensor for input to your selected Crop Algorithm.
5. Be sure to match nozzles and/or rate control system to maximize response time and performance for each field's requirements.

For more information, see Field preparations for nitrogen application (page 217) for more details, and be sure to consult your application equipment and rate control systems manuals as applicable.

Field preparations for user defined rate

The RT200 system can be used to apply other materials than nitrogen. GreenSeeker permits a custom algorithm to be entered (which is a table of product values) instead of the NDVI value. These values are entered into the *Custom Formula Application* table. See Create a custom table (page 369).

Note *– The grower/consultant must develop these rates. Also be aware of the rate range ability of your specific rate controller and nozzles used to achieve these results.*

Field calibration

You can use a GreenSeeker hand-held to measure the NDVI of a crop if you know the approximate desired rate for the crop.

Note *– You can also measure NDVI using the GreenSeeker RT200 by observing NDVI values on the GreenSeeker panel or by using the calibration function.*

Delivery system and liquid control

As with any variable rate system, the minimum and maximum rates obtainable are dependent upon the delivery system. The RT200 interface module is capable of "requesting" any rate, but the actual rates delivered are dependent upon the rate controller and its components. Most liquid rate control systems control or "throttle" the pressure of the system to affect flow and application rate.

When using the RT200 with a typical liquid delivery system, it is important to match nozzle sizes to expected delivery rates. After the appropriate reference strip readings, GDD, and selection of crop type are input into RT Commander, the application graph can be accessed to show the prescription rates at various sensor NDVI readings. Depending upon what delivery system is used, there will be actual minimum and maximum rates obtainable. These will be dependent upon components like the pump, control valve, nozzles, and boom plumbing sizes.

GreenSeeker has features that allow for minimum and maximum rates to be set, regardless of the crop algorithm prescription. After a nozzle set is chosen, the minimum should be set at the lowest rate the nozzles will still give adequate pattern/performance. Maximum rates may be limited by rates that lessen atomization or drift.

Select a nozzle

It is usually best to match nozzles to the lower mid-range of the typical rates shown on the application graph. Ultimately, it is up to the grower or crop consultant to determine the minimum or maximum rates and nozzles which are most appropriate.

If most of your NDVI readings (in the area of the field, not in the NRS) are around 0.53, and your review the application graph shows at 0.53 NDVI you should be applying 15GPA, then you should choose a nozzle that will have the ability to change rates above and below this NDVI reading.

You might choose a nozzle that puts out 12.5GPA at its lowest pressure (such as 20psi) and 21GPA at its highest pressure (such as 60psi). Since the penalty to under-fertilize (harm yield) is usually greater than to over-fertilize (waste fertilizer), it may be best to choose a strategy similar to the one shown here. You will need to modify your values to fit your circumstances and meet the local field and delivery system conditions.

CHAPTER 11

ISOBUS setup

In this chapter:

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Virtual Terminal setup **222**

Task Controller setup **222**

GPS output settings **223**

Equipment setup **224**

ISOBUS is a global set of software and hardware standards that makes possible the communication between equipment made by different manufacturers.

ISOBUS settings

To set up ISOBUS features:

1. Connect the CAN bus to the FM-1000 integrated display.
2. Activate the feature/plugin you want to use. See Optional features/plugins (page 37).
3. If you are using Task Controller, unlock the feature.
4. Set up the feature you are using. See Virtual Terminal setup (page 222) or Task Controller setup (page 222).
5. Set up GPS speed output. See GPS output settings (page 223).
6. Set up the specific virtual terminal for your equipment. See Equipment setup (page 224).

For operational information, see ISOBUS operation (page 373).

Virtual Terminal setup

1. At the *Home* screen, tap .
2. At the *Configuration* screen, select Virtual Terminal and tap **Setup**.
3. At the *Virtual Terminal Dialog* screen, select the port the CAN bus is plugged into .
4. Tap **OK** to return to the *Configuration* screen.
5. Tap **OK** to return to the *Home* screen.

For operational information, see Virtual Terminal operation (page 374).

Task Controller setup

Make sure you have:

- Connected the CAN bus to the display
- Unlocked the ISOBUS Task Controller functionality
- Activated Task Controller

1. On the *Home* screen, tap . The *Configuration* screen displays.
2. At the *Configuration* screen, select Task Controller and then tap **Setup**.
3. At the *Task Control Setup* screen in the Rates tab, enter the settings.

Setting	Explanation
Target Rate 1	The first target rate for the volume supplied by the implement
Target Rate 2	The second target rate for the volume supplied by the implement
Rate Increment	When you increment/decrement Rate 1 or Rate 2 on the *Run* screen, the current application rate increases or decreases by this amount.
Minimum Rate	Minimum rate to be applied
Maximum Rate	Maximum rate to be applied

4. In the Boom tab, enter the Valve On Latency and Valve Off Latency. These values are the measured times that it takes the implement to start coverage after the command is given.
5. Tap **OK** to return to the *Configuration* screen.
6. Tap **OK** to return to the *Home* screen.

For operational information, see Task Controller operation (page 373).

GPS output settings

1. At the *Home* screen, tap . The *Configuration* screen displays.
2. Select GPS Receiverand then tap **Setup**.
3. On the Settings tab, tap **GPS Output**.
4. On the CAN GPS tab, set:
   a. The Message Rate to 5 Hz
   b. The Output Port to be the CAN attached to the ISOBUS for the implement
5. Tap **OK** until you are back at the *Home* screen.

Equipment setup

Make sure that you have set up the Virtual Terminal and/or Task Controller before completing the rest of this procedure.

For cabling information, see FM-1000 Integrated Display Cabling Guide.

1. At the *Home* screen, tap . The *Configuration* screen displays.
2. Select Virtual Terminal then tap **Diagnostics**. The Virtual Terminal for the equipment you have connected displays.

   For Kinze:

Type	Models	Set...	Virtual Terminal	Task Controller
Planter	3110, 3140, 3200, 3500, 3600, 3660, 3700, 3800	Current Ground Speed Source to GPS Speed.	x	x
		Population Option to Prescription.		x

   For Kuhn:

Type	Models	Set...	Virtual Terminal	Task Controller
Seed Drill	Moduliner (HR 6004 ML)	Simulated Speed to the speed you will drive.	x	x
Spreader	AXIS-H-EMC (40.1 & 50.1)	Task Control to On.		x
		GPS Control to On.	x	x
		Set VariSpread to On.		x
		Set Change Disc Speed to On.		x
Spreader	AXIS-W (40.1 & 50.1)	Manual Speed to the speed you will drive.	x	x
		GPSC to On.		x

For Kverneland:

Type	Models	Set...	Virtual Terminal	Task Controller
Spreader	Exacta TL GEOspread	Driving Speed Signal to GPS J1939.	x	x
		Task Controller to On.		x
Drill	Accord Optima Precision Drill	Driving Speed to GPS J1939.	x	x
		Task Controller to On.		x
Drill	Monopill SE	Driving Speed Signal to GPS J1939.	x	x
		Task Controller to On.		x

For Rauch:

Type	Models	Set...	Virtual Terminal	Task Controller
Spreader	AXIS-H-EMC (40.1 & 50.1)	Task Control to On.		x
		GPS Control to On.	x	x
		VariSpread to On.		x
		Change Disc Speed to On.		x
Spreader	AXIS-W (40.1 & 50.1)	Manual Speed to the speed you will drive	x	x
		GPSC to On.		x

For Vicon:

Type	Models	Set...	Virtual Terminal	Task Controller
Spreader	RO-EDW GEOspread	Driving Speed Signal to GPS J1939.	x	x
		Task Controller to On.		x

3. Refer to the equipment manufacturer's operating instructions for how to change the settings.
4. If you are using the Task Controller, verify that the equipment recognizes it. For more information, refer to the equipment manufacturer's operating instructions .

CHAPTER 12

Serial Rate Control setup

In this chapter:

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Rawson and New Leader **234**
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By using a serial connection, serial rate control enables you to use the FM-1000 integrated display with non-Trimble variable rate controllers. A simple variable rate serial cable provides a link between your display and variable rate application controller.

Supported variable rate controllers

The FM-1000 integrated display can send control signals to vary only one channel at a time.

Variable rate controller	Supported Models
Amazone Amatron + (page 229)	Amatron+
Bogballe Calibrator (page 230)	Calibrator Zurf
Hardi 5500 and 6500 (page 231)	5500, 6500
LH Agro (See LH5000 (page 232).)	LH5000
New Leader (See Rawson and New Leader (page 234).)	Mark III and Mark IV
Raven (page 232)	SCS 440, 440DB, 450, 450DB, 460, 660, 661, 700, 710, 750, 760
Rawson (See Rawson and New Leader (page 234).)	Accu-Plant and Accu-Rate
Tyler (See Flex-Air setup (page 230).)	Flex-Air
Vaderstad Control Station (page 235)	Control Station

Variable rate controller setup

1. At the *Configuration* screen, select Serial Rate Control and then tap **Setup**. The *Edit Variable Rate Controller settings* screen displays.
2. At the Comm tab, complete the settings.

   Note *– The fields that appear on the screen depend on which controller you selected.*

Setting	Explanation
Controller	The make of the controller.
Port	The display port the controller is connected to.
Active Channel	If displayed, enter the channel name.
Send Rate as	Unit of measure.

3. Select the Rates tab and enter the settings.

Default Rate	
Step Size	The increment for adjustment
Rate Snapping	Enabled, disabled

4. Select the Sections tab.
5. Enter the number of sections. Then tap **OK**.

After you have selected a type of variable rate controller, the FM-1000 integrated display initiates communications with the controller each time you open a field. Communications are terminated when you close the field.

If the display cannot communicate with the controller:

- A message displays identifying the problem. If the controller type you chose has a configurable baud rate, the error message includes details of the baud rate that required.
- The applied rate does not display on the *Run* screen.
- Variable rate logging is suspended while the controller is disconnected.

Amazone Amatron +

1. Connect the FM-1000 integrated display to the Amazone Amatron +:
   a. Connect the special adapter cable (P/N 59043) to the display cable (P/N 67091).

2. Set up the controller:
    a. Press **Shift** + **Page** / **Setup** / **Page 2.**
    b. Set RS232 to 57600 baud.

Bogballe Calibrator

To use the Bogballe Calibrator, you need a special adapter cable (P/N 59043) to connect to the cable P/N 67091. Cable P/N 6709 will be connected to Port A or B on the display . Optionally, you can use an extension (straight through) serial cable.

Note *– The standoff nuts on the Bogballe rate controller may prevent the pins in the cable connector from making a connection. In this case, remove the standoff nuts.*

Controller setup

To set up the controller to operate correctly with the FM-1000 integrated display, tap:

1. **Return**
2. **Return**
3. **Fertil.-Distrib**
4. **Select Type**
5. **Bogballe E/EX**
6. **Accept**

Flex-Air setup

The FM-1000 integrated display can send rates to the Tyler Flex-Air variable rate controller. The controller can have four channels

- Main
- Liquid
- Co-applicator
- Supplemental

Rates from all channels are recorded in the variable rate logging .dbf file, but the display can send rates to only one channel at a time: the active channel.

The Tyler Flex-Air controller uses the GPS speed sent by the display.

Operation

Statistics for the active channel are recorded in:

- The Total_Qty value in the variable rate logging .dbf file
- The Avg_Rate field in the EventHistory .dbf file

If you want to use these statistics, start a new event ***before*** you change the active channel.

Application width

You can individually configure the widths of the boom sections on the controller. The display draws coverage logging at the width of the sum of all the boom sections. If you turn boom sections off, the display varies the width of the coverage polygons according to which boom sections are on.

Hardi 5500 and 6500

1. To connect the Hardi 5500 or 6500 controller, you need a special adapter cable (P/N 59043) to connect to the cable P/N 67091. Cable P/N 6709 will be connected to Port A or B on the display . Optionally, you can use an extension (straight through) serial cable.
   a. Connect the cable to serial port 1 on the Hardi controller.
   b. On the Hardi 6500, use terminal version 1.55 or later and Jobcom version 1.55 or later.
   c. Set the Hardi 6500 to metric units.
2. Set up the controller:
   a. Turn on the controller while holding the **ESC** button.
   b. In the extended menu, use the arrow keys to select the E.4 Data Exchange menu.
   c. Enter the COM 1 setup and complete the settings.

Setting	Enter...
Equipment type	VRA/remote
Protocol	Hardi VRA
Baud Rate	9600

3. Turn off the controller and turn it on again.
4. Go to Menu 2.3 and select VRA/Remote Control Enable.

LH5000

To use the LH 5000 controller, you need a special adapter cable (LH Agro P/N 198-701) to connect to the cable P/N 67091.

1. Connect the FM-1000 integrated display to the LH5000 by either:
    a. Connecting the special adapter cable (LH Agro P/N 198-701) to connect to the display cable (P/N 67091). Cable P/N 6709 will be connected to Port A or B on the display .
    b. Connecting the display to the controller with an extension (straight through) serial cable.
2. Set up the controller, press:
    a. **Return**
    b. **Return**
    c. **Fertil.-Distrib**
    d. **Select Type**
    e. **LH5000**
    f. **Accept**

Raven

To use a Raven controller with the FM-1000 integrated display, the controller must:

- Be GPS-ready
- Use Raven's latest communications protocol (which was introduced in 1996).

If your controller is not GPS-ready or does not use the latest protocol, contact Raven for an upgrade pack.

Cable P/N 6709 will be connected to Port A or B on the display . Cable P/N 6709 will be connected to Port A or B on the display .

Configure the controller

Screen or Setting Type	Settings	Additional Information
Data Menu	• BAUD: 9600 • GPS: Inac • DLOG: ON • TRIG: 1 • UNIT: Sec	Some Raven controllers may lose the settings if power is disconnected. You must then reconfigure the controller.
Implement Boom Setup	Application width: • First boom section width must be greater than 0, otherwise the display will not communicate with the controller. • Total boom section width must match the Application Width setting in the *Implement Boom Setup* screen.	The display varies the width of the coverage polygons according to the number of boom sections, but it does not know the absolute width of each boom section. It only knows the relative width of each boom section with respect to the total boom section width. When recording coverage polygons, each section is considered to be a percentage of the application width set in the *Implement Boom Setup* screen. For example, if you create an intentional overlap to avoid gaps in the application coverage by making the application width greater than the swath width. This proportionally changes the recorded width of each boom section.
Channel setting	To allow rates sent by the display to be used by the Raven controller, set channel to either: • Rate 1 (SCS4XX, SCS6XX) • Product X Auto (SCS7XX)	If the controller is set to Rate 2 or Manual, the controller ignores the rates being sent, but the display still records the applied rates.
Baud Rate	9600	Some older controllers are only capable of 1200 baud. Such controllers must be upgraded.

Screen or Setting Type	Settings	Additional Information
		CAUTION – Some Raven controllers do not support zero rates. If the target rate is zero, and spray is still being applied, you must turn off the boom sections manually.

Rawson and New Leader

The Rawson and New Leader controllers use a nominal flow rate (Yield) and a step size to describe rates.

If you have a dual-channel Rawson Accu-Rate controller, see Rawson and New Leader (page 234).

1. At the *Edit Variable Rate Controller settings* screen, set the default rate to match the yield value (or nominal flow rate) in the Rawson controller.

   Any non-zero rate will be adjusted to the nearest value that the controller can select. A rate of zero turns off the hydraulic drive.

   Note *– For best result when creating prescriptions, use rates in 2%, 4%, or 6 $^{2}/_{3}$% increments of the default rate. Select the percentage used on the FM-1000 integrated display.*

2. Put the controller into GPS mode. This allows the display to change the rates on the controller. (Without GPS mode, the display will log only the rates being used.)
   a. Turn on the controller.
   b. Tap the **MODE** button twice.
   c. Tap the **SET** button to switch the controller between GPS and non-GPS.
3. Set up communication between the FM-1000 integrated display and the controller:
   a. Connect the display to the controller with Rawson cable (P/N 69730) and cable (P/N 67091).
   b. Set the controller baud rate to 9600.

Using the controller

When in GPS mode, the hydraulic drive operates only when both the switch and the display allow the drive to be on. Set the hydraulic drive switch on the controller to the ON position. If you need to quickly turn off the hydraulic drive, use the switch on the controller.

Non-GPS mode

The FM-1000 integrated display sends commands to the controller. If communication cannot be established, it may be because the controller is set to Non GPS mode. A message displays and gives

you the option to continue in Non GPS mode.

If the controller is set to Non GPS mode, the display still shows and records as-applied rates. If a prescription is loaded, target rates appear for reference, but these are not used by the controller. In this mode, you must vary rates manually on the controller.

Loss of communication

In GPS mode, if communication with a Rawson controller is lost, the display does not report an error until you cross into a region of the prescription that specifies a different rate.

In Non GPS mode, the display has no way of knowing when communication with a Rawson controller is lost.

Special note on using a Rawson Accu-Rate controller

The display can send rates and record coverage for the Rawson Accu-Rate controller for only one drive at a time: Drive A or Drive B.

To correctly send rates to the controller and log coverage based on the drive master switch:

1. To operate both drives, set the drive that is ***not*** being controlled by the display to Non GPS mode.
2. Connect the display Variable Rate cable to the COM port that matches the drive:
   - To control Drive A, connect to COM A.
   - To control Drive B, connect to COM B. When you use Drive B, set the COM port to COM B. Drive A does not have a configuration for this and will always use COM A.
3. Set Bit 7 mode to off. Bit 7 mode sends two prescriptions and is not supported by the display.

Vaderstad Control Station

1. Connect the FM-1000 integrated display to the Vaderstad Control Station:
   a. Connect the special adapter cable (P/N DCA6219) with a crossover serial cable (null modem) to the Vaderstad program cable (Vaderstad P/N 428017).
   b. Plug the Vaderstad cable into the GPS port on the back of the Control Station controller.
2. Set up the controller:
   a. Press the **?** button and hold it down while turning on the controller.

      Note *– Pressing* **?***and selecting Info will not work if the unit is communicating with the display.*
   b. In the *Setup* screen, scroll to GPS and then select No.

Additional controller setup

You can also set additional features on variable rate controllers, including:

- Coverage mapping (page 236)
- Target and applied rates (page 236)
- Units (page 236)
- Alarms (page 236)

Alarms

If you want low limit and target rate alarms, set these on the variable rate controller. You can also set a default rate to be used if you go off the prescription or do not have a prescription. For more information, refer to the documentation provided with your variable rate controller.

Coverage mapping

The FM-1000 integrated display receives the applied rate and can also receive the number of active boom sections from a variable rate controller. It does not receive any information about the swath or application width.

To accurately record coverage maps, if your controller does not send the number of active boom sections, set the application width to match the agricultural equipment that you are using (for example, the width of the spray boom).

Prescriptions

You can define variable rate controller setup data, and load prescription files that define the rates to be applied in different areas of the field. This information is used to send target rates to the variable rate controller. Applied rates are received from the controller, and both target and applied rates are shown on the screen. In addition, data relating to the variable rate application may be logged to the card.

The information describing prescriptions for the Field-IQ system also applies to non-Trimble variable rate controllers.

Target and applied rates

The FM-1000 integrated display can control only a single channel at any one time. This active channel is specified in the *Edit Variable Rate Controller settings* screen. The target and applied rates shown on the *Run* screen are specific to this active channel.

Units

Most controllers can be configured to use either US Imperial or metric units of measurement. Each channel can be configured to use different types of units (for example, lb/ac, oz/ac, or gal/ac.).

When constructing prescription maps, make sure that the maps use the same units that the controller is configured for.

CHAPTER 13

TrueGuide setup

In this chapter:

TrueGuide system **238**

Implement setup and selection **239**

TrueGuide setup **240**

TrueGuide calibration **241**

The TrueGuide implement guidance system works with the Autopilot system.

TrueGuide employs passive implement control and uses the second GPS antenna on the implemen to achieve implement location accuracy.

TrueGuide setup includes:

- Implement setup
- TrueGuide system setup
- Implement guidance calibration

TrueGuide system

The working implement behind the tractor is where precision counts, and the only way to directly influence the implement is to measure where it is and control it.

While you steer the vehicle, TrueGuide passively controls the implement to steer itself to the guidance line.

The TrueGuide™ implement guidance system:

- Is used in conjunction with the Autopilot system
- Measures the position of the implement with a second GPS receiver placed on the implement. The Autopilot system can then adjust the position of the tractor to pull the implement on the guidance line.

TrueGuide works with towed implements for front-steered, tracked, and articulated tractors.

For operation information, see TrueGuide operation (page 386).

Benefits

With TrueGuide, you can:

- Reduce the uncontrolled drift of the implement.
- Control large implements and minimize the effects of draft (due to varying soil conditions and ground moisture) with no additional steering hardware.
- Guide the implement to the line, even in the most difficult field patterns.
- Tow your implement online when its natural tendency is to pull through curves.
- Prevent unpredictable implement movements due to rolling terrain by adjusting on the go.
- Minimize the effect of downdraft on severe hillsides by having the Autopilot system pull the implement up the hill and hold the line.

To achieve the highest performance from TrueGuide implement guidance, the Autopilot system on the tractor must have a good calibration. An Autopilot system that is calibrated very aggressively may need to be set up with a more neutral calibration when used with TrueGuide implement guidance.

Requirements

To set up and operate, TrueGuide system must have:

- The Autopilot automated steering system installed and configured. See Autopilot system (page 146).

- Stable implements. (Implements that are unstable, such as sprayers with large flotation tires, will cause rocking in the antenna that will be greater than the performance improvements on the ground.)
- Both Autopilot and TrueGuide activated for use. See Activate features/plugins for use (page 45).
- An additional GPS receiver on the implement.

For cabling information, see FM-1000 Integrated Display Cabling Guide.

For operational information, see TrueGuide operation (page 386).

Implement setup and selection

Before you use the FM-1000 integrated display with the TrueGuide system, set up and select a new or existing implement. See Implement setup (page 138).

Note *– You can update existing (saved) implements with implement geometry to support TrueGuide guidance.*

Note *– Antenna offsets are provided when the antenna cannot be placed directly over the working point of the implement. These offsets should be minimized whenever possible.*

Antenna offsets (Geometry tab)

As part of implement setup, settings on the Geometry tab are required for implement modeling. When configuring an implement for the TrueGuide system, the following antenna offsets are required:

Offset	Explanation
Hitch to ground contact point	Measured from the tractor hitch pin to the soil engagement point that the implement rotates around.
Antenna front/back	Measured from the implement working point to the center of the GPS antenna (if mounted).
Antenna left/right	Measured from the center of the implement to the center of the GPS antenna (if mounted)
Antenna height	The working height of the GPS antenna

TrueGuide setup

1. At the *Configuration* screen, select TrueGuide and then tap **Setup**. The *TrueGuide Setup* screen displays.
2. Enter the required settings.

Setting	Explanation
Roll compensation	• On: Applies roll corrections from the tractor. • Off: Applies no roll corrections.
CurveGuide	• Off: The system does not anticipate curves. • TrueGuide only: Enables the system to anticipate curves to make corrections for TrueGuide guidance only. • Always On: Keeps CurveGuide on at all times.
TrueGuide Aggressiveness	The default aggressiveness. The recommended aggressiveness is 100%. See System aggressiveness settings.
Rear axle to hitch point	The distance between the fixed axle for conventional tractors (or the center of rotation for tracked tractors) and the draw bar.

3. Tap **OK**. The *Configuration* screen displays.

System aggressiveness settings

Aggressiveness affects the response of the implement to move to the guidance line. When aggressiveness is:

- Increased: The response to move the implement back to the guidance line is increased.
- Decreased: The response to the implement moving offline is smoothed.

1. At the *Run* screen, tap to open the TrueGuide panel.
2. Use **+** or **-** to increase or decrease the aggressiveness.

For...	Use the default setting...
Steep slopes (10% - +30%)	150%
Slow speed operations	125%

For...	Use the default setting...
Normal operation	100%
High speed applications (> 8 mph or 12.8 kilometers per hour)	33%

TrueGuide calibration

WARNING – Many large and sudden changes in satellite geometry caused by blocked satellites can cause significant position shifts. If operating under these conditions, auto-guidance systems can react abruptly. To avoid possible personal injury or damage to property under these conditions, disable the auto-guidance system and take manual control of the vehicle until conditions have cleared.

To calibrate the TrueGuide system, you must have a field open in the *Run* screen with an AB line configured. See Fields (page 319) and Guidance pattern use (page 323).

At the *Run* screen:

1. Tap . Without closing the field, the *Configuration* screen displays.
2. Select TrueGuide and tap **Calibrate**. The *TrueGuide Calibration* screen displays.
3. Tap **Next** and follow the on-screen instructions.
4. Complete the test at least four times and tap **OK**.
5. At the *Calibration* screen, tap **OK** to return to the open field.

CHAPTER 14

TrueTracker setup

In this chapter:

TrueTracker **244**

Setup process **245**

Implement calibration for TrueTracker system **250**

The TrueTracker feature/plugin works with the Autopilot system. TrueTracker uses active implement control, enabling the vehicle as well as the implement to guide to the line. This improves accuracy and product placement.

TrueTracker

The TrueTracker implement steering system is an optional upgrade for the Autopilot automated steering system. When the TrueTracker system is added to the Autopilot system, the implement receives separate guidance and steering to increase accuracy.

Implement steering actively steers the implement being towed by the vehicle. This prevents the implement from pulling to one side (called implement draft):

- On extremely sloped ground
- In variable soil conditions
- On curved guidance patterns

TrueTracker supports:

- Steering in reverse
- Straight and curved guidance patterns
- Independent implement offset
- Independent aggressiveness control for the implement
- Zero steering to center the coulters

The system has two parts:

- Additional hardware installed on the implement (which requires professional installation)
- Additional FM-1000 integrated display software provided by TrueTracker

For operation information, see TrueTracker operation (page 383).

Requirements

TrueTracker requires:

- An Autopilot system
- An unlock code
- AG-815 integrated radio with secondary receiver
- Second antenna
- Platform kit for the implement actuation type
- Implement NavController and cabling

For information on TrueTracker cabling, see FM-1000 Integrated Display Cabling Guide.

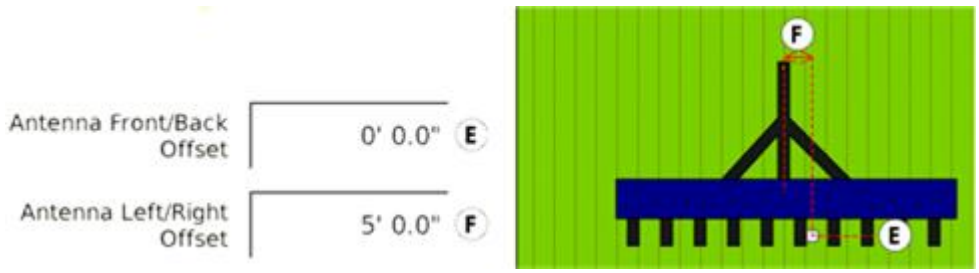
For operation information, see TrueTracker operation (page 383).

Setup process

To set up the TrueTracker system:

1. Activate TrueTracker. See Activate features/plugins for use (page 45).
2. Complete the implement controller settings. See Implement controller setup for TrueTracker system (page 245).
3. Set up the implement so that the system can tell:
   - Which type of implement is attached
   - How much area it covers
   - How far it is offset

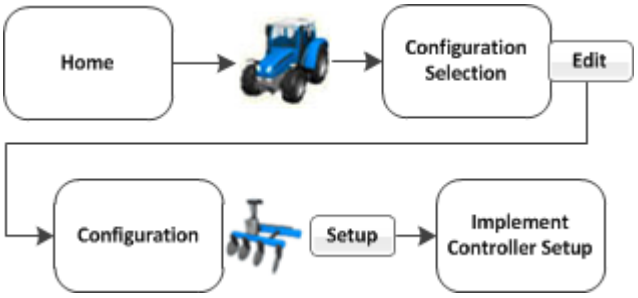
   Make sure you are measuring the offsets from the antenna to the ground interaction point of the implement. See Implement setup (page 138).



Note *– When you enter the number of implement sections, if the implement does not have sections, enter 1.*

4. If necessary, edit the vehicle profile. See Vehicle settings for Autopilot system (page 146).
5. Calibrate the implement. See Implement calibration for TrueTracker system (page 250).

Implement controller setup for TrueTracker system



1. At the *Home* screen, tap . The *Configuration Selection* screen displays.
2. Tap **Edit** next to the implement.
3. At the *Configuration* screen, select TrueTracker and tap **Setup**. The *Implement Controller Setup* screen displays.
4. Complete the:
   - Vehicle settings for TrueTracker system (page 246)
   - Engage settings for TrueTracker system (page 248)
   - Steering settings for TrueTracker system (page 249)

Vehicle settings for TrueTracker system

Note *– Your vehicle make and model were selected when your TrueTracker system was installed. If your vehicle data is correct, there is no need to edit the vehicle settings. If your vehicle data is not correct, edit the implement controller.*

At the *Implement Controller Setup* screen's Vehicle tab, complete the settings.

Setting	Explanation
Connector	Which port on the FM-1000 integrated display the TrueTracker NavController is communicating with. TrueTracker on the FM-1000 integrated display only supports port C or port D on the internal GNSS receivers. Communications for TrueTracker are serial. • Port C uses Internal Receiver 1 • Port D uses Internal Receiver 2 The common practice for the Autopilot/TrueTracker combination is to use Port C for the vehicle and Port D for the implement.
Current Selection	Tap **Edit** if you need to change the: • Vehicle profile • Implement model When you tap **Edit**, the *Edit Implement Controller* screen displays.

Edit vehicle profile

At the *Edit Implement Controller* screen, change the settings as appropriate.

Choose new vehicle make/model

To select a new make and model from a database of vehicles (.vdb) on the display:

Setting	Explanation
Vehicle Profile Location	Select From Database (new).
Model	1. Tap **Browse** and select the required .vdb file. 2. Tap **OK**. After calibrating a TrueTracker implement NavController, it is recommended to save the configuration: 1. Tap **Edit** and then Save Implement to file. 2. Enter the file name and tap **OK**. ***Note*** *– This is the only method by which to save an implement TrueTracker NavController configuration.*

Choose existing vehicle

To select an existing vehicle from a previously saved file on the display:

Setting	Explanation
Vehicle Profile Location	Select From Saved file (existing).
Model	1. Tap Browse and select the required .vdb file. 2. Tap Open. 3. Tap **Change/Restore Implement**. The following message displays: The specified implement model will now be selected on the Autopilot controller. This will cause the Autopilot controller to be reset. Do you want to continue? 4. Tap OK to load the new configuration. A message displays information you the Autopilot controller will now be reinitialized. 5. Tap OK. Read the warnings and tap OK. The file is now loaded.

Change or restore implement

The **Change or Restore Implement** button is only active when you have selected either a new .vdb or a saved configuration. Until then it is not available for use.

The button is used to acknowledge and apply/load the desired .vdb or .config.

Engage settings for TrueTracker system

At the *Implement Controller Setup* screen's Engage tab, complete the settings as appropriate.

Setting	Explanation
Operator Timeout	Amount of time allowed before the operator receives an alert for lack of activity. If the operator fails to respond to the alert, the vehicle begins to drive in a tight loop.
Coverage Log	Manual: Coverage logging starts only after you tap . When Engaged: Coverage is logged when the Autopilot system is engaged if no other system is controlling logging (such as Field-IQ or Yield Monitoring). This setting can be edited in both the vehicle and implement setup. A change in one setup location will show up in the other setup location.
Two State Engage	Off: The **Engage** button engages with one tap: • First tap: Engages implement and vehicle steering • Second tap: Disengages both implement and vehicle steering Implement First: The **Engage** button engages with one tap: • First tap: Engages the implement steering • Second tap: Engages the vehicle steering • Third tap: Disengages both implement and vehicle steering Vehicle First: The **Engage** button engages with one tap: • First tap: Engages the vehicle steering • Second tap: Engages the implement steering • Third tap: Disengages both implement and vehicle steering

Steering settings for TrueTracker system

At the *Implement Controller Setup* screen's Steering tab, complete the settings.

Setting	Explanation
Nudge Increment or Trim Increment	Set the amount by which the Nudge or Trim buttons move the line back to the correct path, or by which the **Trim** buttons move the vehicle position. The guidance line can move off target (requiring **Nudge**) as a result of: • GPS position drift when you return to the field for guidance, for example after you pause or turn off the system • GPS satellite constellation changes as you drive in the field The vehicle can steer offline (requiring **Trim**) as a result of: • Uneven drag on a vehicle from an unbalanced implement. • Uneven drag on a vehicle from soil conditions.
End of Row Warning	Distance before the end of row warning occurs. ***Note*** *– Longer vehicles that take longer to turn need an earlier warning and a greater distance.*
Autosense	On or Off
Valve on Speed	For vehicles operating at speeds that are: • Normal: Select Normal > 0.4 m/s (1.3 ft/s). Additional settings are supported only with NavController firmware versions 5.10 and later. • Slow: Select Low > 0.1 m/s (0.3 ft/s) or Ultra low > 0.02 m/s (0.07 ft/s).

Implement calibration for TrueTracker system

The auto steering system must be calibrated for the implement you are using.

1. At the *Configuration* screen, select TrueTracker and then tap **Calibrate**. The *Implement Controller Calibration* screen displays with a list of items to calibrate.
2. Select each item and tap **OK**.
3. Complete the calibration.

Controller orientation setup

1. At the *Implement Controller Calibration* screen, select Controller Orientation and tap **OK**. The *Autopilot Controller Orientation* screen displays with a graphic that represents how the controller is oriented in the cab. (If the controller is in an orthogonal orientation, a graphic of it displays. If it is not in this orientation, no graphic will be displayed.)

   The graphic of the controller is shown as though:

   - You are looking down on the vehicle from above.
   - The top of the screen points to the front of the vehicle.
2. Tap the buttons to select the orientation of the controller. The graphic of the controller will change as you tap the buttons.
3. If the controller is set at a sloped angle, tap the Direct Entry tab. Then enter the yaw, pitch, and roll angles of the controller.

   Note *– If you use direct entry to enter custom angles, the on-screen image of the controller does not display.*
4. Tap **OK** to accept the new orientation or tap **Cancel** to exit.

Proportional Steering Gain calibration

WARNING – The wheels can move abruptly during the Proportional Steering Gain procedure while the Autopilot system tests the hydraulic response to the steering commands. These sudden movements can cause collisions with nearby obstacles or cause injury to occupants of the vehicle. Be prepared for sudden wheel movements.

Note *– Complete this calibration* ***only****:*
- When the TrueTracker system's performance is less than acceptable
- After you complete *Implement Steering Sensor calibration (page 252)*

The proportional steering gain (PGain) setting enables you to reach a compromise between rapid steering response and stability. Modifications to the PGain setting affect two steering characteristics:

- Slew Time: The amount of time the steering coulters take to move from the far left to the far right position and from the far right to the far left position.
- Overshoot: The percentage by which the steering coulters exceed the commanded angle before they settle on the correct value.

Prior to completing this calibration:

- Complete the steering sensor calibration ***before*** you perform the proportional gain calibration.
- Perform the Automatic Deadzone calibration immediately before you run the PGain calibration, even if the Automatic Deadzone calibration has been performed in the past.
- Perform this calibration on a level surface, that is free of obstructions.
- Run the engine at full throttle.
- Raise the implement.

To correct slight variations caused by valve current response, friction, and hydraulic fluid viscosity, alter the PGain values:

- High PGain values: Decrease the slew time and increase the overshoot. This provides rapid responses, but can cause the steering to exhibit signs of instability (for example, a tendency to excessively overshoot).
- Low PGain values: Increase the slew time and decrease the overshoot. This improves the stability but can introduce significant delays in the steering response and can cause the vehicle to oscillate from side to side.

Increase the proportional gain up to the point just before any one of the following occurs:

- Slew times no longer decrease (a low value is required)
- Overshoot exceeds 10% (depending on the Tracker unit)
- Steering coulters noticeably shake near end stops

Calibration steps

1. At the *Implement Controller Setup* screen, select Steering Gain and tap **OK**. The *Autopilot Steering Gain Calibration* screen displays.
2. Tap **Next** to continue. The second *Autopilot Automated Deadzone Calibration* screen displays.
3. Tap **Next** for the next two screens that display.
4. Follow the instructions. The system will automatically move the coulter wheels in both directions several times.

WARNING – The steering coulters can move abruptly during the Proportional Steering Gain procedure while the TrueTracker system tests the hydraulic response to the steering commands. These sudden movements can cause collisions with nearby obstacles or cause injury. Be prepared for sudden steering coulter movements.

5. Tap **Start**. The system engages and performs the calibration.
6. Tap **Run Slew Test**. A warning message displays.
7. Tap **Next**.
8. Tap **Next** in the two screens that display next.
9. Test various gain settings while you monitor the implement steering performance and the values for Slew Time and Overshoot during the Turn Left phase.
10. Adjust the New Gain value (if required).
11. Tap **Turn Left**. Both turn buttons are unavailable while the wheels slew.

    Note *– The optimum gain setting has short slew time (short millisecond reading) and overshoot percentage less than 10%.*
12. Repeat Step 11 with **Turn Right**. Both turn buttons are unavailable while the wheels slew.
13. When you reach the best gain value, tap **OK** to save the value in the Autopilot controller memory.
14. If you want to restart the calibration procedure, tap **Cancel**.

Implement Steering Sensor calibration

Note *– Complete this calibration **before** you calibrate the Automated Steering Deadzone or Antenna Roll Correction.*

This calibration converts the voltage output of the steering sensor into an equivalent steering angle measurement.

Note *– This calibration is only available for implements that have a steering sensor providing feedback for the steering mechanism location. Sideshift hitches do not use this calibration.*

Make sure that you:

- Perform this procedure on a level surface that is free of obstructions.
- Follow the instructions on each page.
- Run the engine at full throttle.
- Raise the implement.

Calibration steps

1. At the *Implement Controller Calibration* screen, select Implement Steering Sensor Calibration. The *Implement Steering Sensor Calibration* screen displays.
2. For vehicles with coulters, make sure they are raised out of the ground. For other articulation methods, make sure the vehicle is slowly moving forward in a wide open space to allow free movement of the steering mechanism.
3. Tap **Start**.
4. Perform the calibration. The system will automatically steer to the right and to the left. The value for Volts updates as the wheels are steered.

Implement Automated Deadzone calibration

The Automated Deadzone calibration for the implement runs a series of tests on the valve and steering hydraulics to determine the point at which steering movement occurs. In this test, the system independently opens and closes each side of the steering system while determining the point at which wheel movement occurs.

WARNING – During the Implement Automatic Deadzone calibration, the system moves the wheels that steer the implement. To avoid injury, make sure that the area around the vehicle and implement is clear.

Before you begin calibration:

- Complete the Implement Steering Sensor calibration (page 252).
- Make sure the hydraulic fluid is at normal operating temperature when you run this procedure (to ensure optimal system performance). On some vehicles with large reservoirs, it may take several hours for the fluid to reach operating level, especially if the implement circuit is lightly loaded. Consult the vehicle documentation to determine if the hydraulic fluid temperature can be shown on a vehicle console.

  If you perform the calibration while the system is still cold, repeat both the Deadzone and the Proportional gain calibration procedures after the system is at operating temperature.

Calibration steps

1. Place the vehicle in an area that is free of hazards.
2. Raise the implement.
3. At the *Implement Controller Setup* screen, select Implement Automatic Deadzone and tap **OK**. The *Autopilot Automated Deadzone Calibration* screen displays.

   Note – *Read the onscreen instructions on each page.*
4. Tap **Next** to continue. The second *Autopilot Automated Deadzone Calibration* screen displays.
5. Tap **Next** in the two screens that display next.

6. Follow the instructions. The system will automatically move the coulter wheels, steering wheels or other mechanism in both directions several times.
7. Tap **Start**. The system engages and performs the calibration.

Automated Deadzone error messages

If a calibration cycle is unable to complete successfully, an error message will display.

Message: Error -	Explanation
Steering Close To End Stops	Before the calibration cycle could be completed, the measured steering angle approached the end stops. Retry, and if the problem persists, instead of centering the steering at the start of each cycle, try turning the steering in the opposite direction to that which is being tested so that the calibration procedure has a greater range to test over.
Valve Connectors Could Be Swapped	The calibration test sensed the steering turning in the opposite direction to what was expected. Retry, and if the problem persists either the valve connectors have been accidentally swapped or the steering sensor calibration was performed incorrectly.
No GPS	A GPS receiver must be connected and outputting positions before the software can run the calibration procedure.
No Steering Response Detected	During the calibration cycle, insufficient movement was sensed in order for the calibration to complete. If the problem persists, the hydraulic installation could be faulty.
Unable To Determine DZ: Try Again	A problem occurred when trying to compute dead zone. Retry, and if the problem persists, contact Technical Support.

Antenna position and roll offset correction

Before configuring the antenna compensation, make sure that:

- TrueTracker is completely set up.
- The Autopilot system is properly configured. See Autopilot system (page 146).
- The correct GPS corrections are enabled. See GPS receiver settings (page 98).

1. At the *Implement Controller Setup* screen, select Roll/Antenna Compensation and tap **OK**. The *Autopilot Roll/Antenna Compensation* screen displays.
2. Enter the appropriate settings and tap **OK**. Make sure the value entered for antenna height and distance from centerline match those entered under Implement Geometry.

Setting	Explanation
Antenna Height Above Ground	a. Place the tractor and implement on a flat, level surface. b. Measure the distance from the ground to the base of the GPS receiver (or antenna). c. Enter this value in the Antenna Height Above Ground entry box.
Antenna Distance from centerline	a. Place the tractor and implement on a flat, level surface. b. Measure the distance from the centerline of the implement to the center of the GPS receiver (or antenna). c. Enter this value into the Antenna Distance from centerline entry box and indicate whether it is left or right of the centerline. ***Note*** *– Values to the left of the centerline are displayed as negative numbers. The nose of the vehicle is considered the forward direction.*
Roll Offset	a. Choose the method that best matches the conditions to calculate the roll offset: Coulter wheel track offset method (page 255) or Flag offset method (page 256). b. Enter the average offset value in the Roll Offset entry box.
Implement Position	Select the offline direction, depending on whether the roll offset distance is to the left or right.

Coulter wheel track offset method

WARNING – The steering coulters can move abruptly during the Proportional Steering Gain procedure while the TrueTracker system tests the hydraulic response to the steering commands. These sudden movements can cause collisions with nearby obstacles or cause injury. Be prepared for sudden steering coulter movements.

1. Drive the tractor to a relatively flat field where tire impressions are visible and where you can complete passes of at least 400 m (1320 ft) in length.
2. Reset the roll offset value to 0 (zero).
3. Start a new field.
4. Create a straight AB Line.

5. Create a clean set of tire tracks in the field. To do this, start a new pass away from the area where the AB Line was created. When the system is stable, engage automatic steering mode and allow the Autopilot and TrueTracker systems to complete the pass.
6. At the end of the pass, turn the tractor around to return along the same pass from the opposite direction.
7. Engage automated steering mode and allow the system to complete the pass.
8. In the middle of the return pass, stop the tractor and confirm that the current position is directly on the AB Line. This ensures there is no cross track error.
9. Park the tractor and exit the cab. Evaluate the coulter wheel track pattern between the first and return paths.
10. Measure the difference between the track passes and record the distance. Also note whether the return pass is to the left or the right of the original pass. Record the results.

    Note – *The offset should be consistently to the left or right.*

Test Run	Offset distance	Offset direction
1		
2		
3		
Total =		
Total / 3 (average offset value) =		

11. Repeat steps 5 through 10 two more times, for a total of three test runs. Average the results of the three runs. (Total the offset distances from the three passes and divide by three). Use the table in step 10 to record your results.

Flag offset method

1. Drive the vehicle to a relatively flat area where you can complete passes that are at least 400 m (1320 ft) in length.
2. Reset the Roll Offset value to 0 (zero) on the *Roll Correction* screen.
3. Start a new field.
4. Create a straight AB Line.

5. Start a new pass. Engage automatic steering mode when the system is stable. Stop the tractor midway through the pass. Confirm that there is no cross track error: the current vehicle position should be directly on the AB Line.
6. Park the vehicle and exit the cab. Insert a flag in the ground to mark the implement centerline for this pass.
7. Complete the pass. Turn the vehicle around to return along the same pass from the opposite direction.
8. Engage automatic steering mode. Stop the vehicle midway down the pass very close to the marker flag. Confirm that there is no cross track error. The current vehicle position should be directly on the AB Line.
9. Park the vehicle and exit the cab. Insert a second flag in the ground to mark the implement centerline for this pass. Note whether the second pass is to the left or the right of the first pass.
10. Measure the difference between the flags for the two passes and record the distance. Also record whether the return pass is to the left or the right of the original pass. Record the results.

    Note *– The offset should be consistently to the left or right.*

Test Run	Offset distance	Offset direction
1		
2		
3		
Total = Total / 3 (average offset value) =		

11. Repeat steps 5 through 10 two more times, for a total of three test runs. Average the results of the three runs. (Total the offset distances from the three passes and divide by three). Use the table in step 10 to record your results.

Line Acquisition Aggressiveness calibration

1. Atthe *Implement Controller Setup* screen, select Line Acquisition and tap **OK**. The *Autopilot Line Acquisition*creen displays.
2. Adjust the line acquisition aggressiveness slider.

The slider controls how aggressively the implement approaches the guidance line, using a scale from 50% to 150%. The optimal value for each profile is not necessarily 100%. It varies for different implement profiles.

CHAPTER 15

Vehicle Sync setup

In this chapter:

Vehicle Sync **260**

Setup steps **260**

Vehicle Sync integrates with the Field-IQ crop input control system, Tru Count clutches and the Yield Monitoring system.

Multiple users can share coverage maps, providing section control for minimized overlap and seed savings during planting season.

In conjunction with the Field-IQ system and Yield Monitoring, Vehicle Sync can influence seed placement as well as the header for increased accuracy.

Vehicle Sync

Vehicle Sync supports up to six vehicles within range of approximately 325 yards (300 m) and in direct line of sight with each other.

Requirements

For Vehicle Sync, you need:

- FM-1000 integrated display
- Vehicle Sync unlock
- DCM-300 Modem (page 125)
- High-gain Wi-Fi antenna kit

For operational information, see Vehicle Sync operation (page 388).

Setup steps

1. At the *Home* screen, tap . The *Configuration* screen displays.
2. Select Vehicle Sync and tap **Setup**. The *Vehicle Sync Configuration* screen displays.
3. On the Setup tab, enter the appropriate settings.

Setting	Explanation
Channel	Make sure that the channel that is selected is the same on all the vehicles that you want to link. You can link up to six vehicles.
Static IP	Must be unique for each vehicle being synced. If two vehicles have the same IP address, tap **Generate New** for one of the displays. **CAUTION –** Do not remove power from the display or the DCM-300 modem for 10 minutes after you tap the **Generate New** button.
Display Name	Enter a descriptive name that will be easy to recognize and select when you join the vehicles. ***Note*** *– If you already have Office Sync, this item is populated with the vehicle name that you set up earlier.*

4. On the Data tab, complete the settings and tap **OK**.

When there is excessive data transfer, the FM-1000 integrated display may slow down. To help with this, it may be useful to limit the amount of data sent back and forth between displays .

The Coverage and Comms Strategy settings enable you to limit the amount of data the display sends out. For this to be effective, it is recommended that you limit the data sent out for all displays in the group .

Setting	Explanation
Coverage	• All Layers: This transfers all applied layers for the Field-IQ system. • Layer 1 only: This setting limits transfer and receiving of data to only the first product.
Comms Strategy	• Original: All displays always broadcast data. Every display in the workgroup is talking always and at the same time. This slows down communication traffic across the DCM and is used for heavy traffic workgroups. • Round-Round Robin: Each display takes turns communicating information to the rest of the work group. Displays talk one at a time instead of the original format.

CHAPTER 16

Water Management setup

In this chapter:

Water Management features **264**

FieldLevel II Survey/Design **265**

FieldLevel II Leveling **268**

Tandem / dual scraper setup **275**

WM-Drain setup **278**

Water Management functionality includes survey, design, leveling and WM-Drain functions.

Water Management features

Water Management includes:

- Survey: Creating surveys of areas. You use a high-accuracy GPS receiver on the water management implement to create a topographic survey of the layout of your field. The three-dimensional data shows the surface topography of the land.

  Note *– If you are working in a field that has already been leveled, you may not need to perform a survey and you can go straight to leveling with the FieldLevel II system or installing tile using WM-Drain.*

- Design: After you complete the survey, you can use it to design the optimum drainage slope that can be graded with minimal dirt movement.
- Leveling: After you create a survey of the field and a design for how to modify it, you can use FieldLevel II to control a land-leveling implement on your vehicle and to adjust the land to an optimal slope.
- WM-Drain: Surface and subsurface drainage installation

Water Management system enables you to:

- Conserve precious water resources and help control the water table.
- Reduce erosion and conserve topsoil.
- Perform touch-up leveling each year.
- Use technology with a larger operating range than a laser and no vertical limit.
- Work with your existing agriculture guidance products to manage your fields with one collective system. For example, you can connect the Autopilot system to the FM-1000 integrated display at the same time as the implement.

Requirements

The Water Management system requires:

- An FM-1000 integrated display, with or without the Autopilot system
- A platform kit to suit your vehicle and valve type (P/N 55045-xx)
- An unlock code for the water management functionality
- A leveling or drainage implement

FieldLevel II Survey/Design

Benchmarks

Before you can create a survey, you must set a point at a known location called a benchmark. When you create a benchmark, the GPS receiver obtains and records location information from the base station for that specific point in your field.

When you are leveling, you use benchmarks to:

- Return to a point in the field with known coordinates to re-calibrate your exact position. This may include setting the bucket on the ground or on a solid surface that will not be disturbed while you perform field leveling.
- Move the design up or down to match the field surface at that point.

The first benchmark you create on a field is the master benchmark and displays as an orange flag labeled **MB** . Field coordinates are calculated from this point.

Subsequent benchmarks display as orange flags labeled with their corresponding number .

When you tap a button to create a benchmark, a countdown timer runs for 30 seconds and then the system creates the benchmark. To stop the averaging during the countdown, tap **Bench** again.

Rebenching

If you plan to shift the location of the base station each time you use the survey data, you can configure the system to force a re-bench. The system will not allow you to engage automatic control until the system has been re-benched.

When you are within the circle around an existing benchmark, a message displays on the *Run* screen telling you how close you are to that benchmark.

If you tap the **Rebench** button when the receiver is within the circular radius of a benchmark, the receiver is calibrated over the existing benchmark.

When you re-bench, the system automatically selects the benchmark closest to you but allows you to select the benchmark you want to use.

Settings

1. Activate FieldLevel Survey/Design for use. See Activate features/plugins for use (page 45).
2. At the *Configuration* screen, select FieldLevel Survey/Design and tap **Setup**. The *Survey Setup* screen displays. Complete the settings.

Setting	Explanation
Survey Height Offset	Represents the difference between the height of the blade when surveying, and the height of the blade when moving dirt. To measure this value, park the implement on a flat surface and raise the blade up to its highest limit and then measure the distance from the bottom of the blade to the surface of the ground. The Survey Height Offset will be applied to all surveys to avoid the need to re-bench between Survey mode and moving dirt.
Survey Point Density	When you create a survey of a field, this setting determines the distance between the collected survey mapping points. The approximate distances between points are: • Coarse: 7.8 m (25 ft) • Medium: 3 m (10 ft) • Fine: 1.5 m (5 ft)
Cut/fill Color Range	Defines the vertical range in which the colors are spread over the cut/fill map. The cut/fill map displays only after you have surveyed the field and defined a design plane. The range is displayed from the highest cut value to the highest fill value. For example: If your highest cut value is 1 foot and your highest fill value is 1 foot, and you set your Cut/fill color range to 2 feet, then the colors will be spread evenly across your cut/fill map. If you change the cut/fill color range to 1 foot, the colors will become more focused around the neutral area, providing more detail closer to the grade.

3. Select the Relative Heights tab and complete the settings.

   By default, coordinates are recorded relative to the master benchmark. Setting relative positions establishes the coordinates of the master benchmark when it is set. These coordinates are then used for field leveling and topographic mapping every time the field is opened.

Setting	Explanation
Relative Heights	Select Enabled from the list. By default, coordinates are recorded relative to the master benchmark. Setting the relative positions establishes the coordinates of the master benchmark when it is set. These coordinates are then used for field leveling and topographic mapping every time the field is opened.
Relative X	X-axis coordinate (Relative X)
Relative Y	Y-axis coordinate (Relative Y)
Height Offset	height (Height Offset)
Force Re-bench	Whether the system will force you to re-bench each time that you reload the field. ***Note*** *– If you choose No, the RTK base station must be placed in exactly the same position for the field to be correct.*

4. Tap **OK** to return to the *Survey Setup* screen.

Tip – To view relative offset values on the Run screen, set the offsets as status text items on the slide-out tab.

For operational information, see Create / save a design (page 395).

FieldLevel II Leveling

The FieldLevel II system:

- Uses a high-accuracy GPS receiver with an antenna mounted on the implement blade to measure and control its elevation
- Defines the three-dimensional height for the field and controls how the implement reshapes the ground
- Automatically raises and lowers the blade on the implement to match the design height anywhere in the field
- Includes a color cut/fill map, simple on-screen adjustments, and automatic blade control makes leveling easy
- Supports tandem or dual scraper implements
  - With a tandem system, the second scraper is also controlled by GPS. You can work in areas requiring cuts and fill two scraper buckets before you have to empty the scrapers.
  - With a dual system, an antenna on each side of the scraper controls two independent cylinders. This creates a more accurate surface by controlling the height of both ends of the scraper.
- Supports the EZ-Remote joystick or with custom switches controlled by a Signal Input Module (SIM)

Requirements

The FieldLevel II system requires:

- FM-1000 integrated display, with or without the Autopilot system
- Platform kit to suit your vehicle and valve type (P/N 55045-xx)
- Unlock code for the field leveling functionality
- Leveling or drainage implement

Setup process

Note *– Before you can configure the system, it must be professionally installed. For more information, contact your local reseller.*

FieldLevel II setup and calibration include:

1. Implement settings for FieldLevel II (page 269)
2. GPS receiver setup (page 269)

3. FieldLevel II settings (page 270)
4. Valve module calibration (page 273)

Leveling models

The FieldLevel II system has five leveling models:

- Point and Slope: The system levels at a consistent upward or downward slope, regardless of the vehicle's direction. This can be useful for installing tile and field drainage.
- Multiplane Design: The FieldLevel II system supports external leveling designs from Multiplane design software. This software can run a wide range of "what if" scenarios, enabling you to create complex designs with multiple field sections. You can export these design control files and then load them into the FieldLevel II system to shape the field surface based on the work in the office.
- Plane (flat): Use this leveling model to level a field that has previously been measured with a laser. The FieldLevel II GPS system will correct the design heights to a plane surface to match your previous laser system.
- Plane (Earth Surface): Use this model to level a field using the FieldLevel II GPS system. No corrections will be made to a flat plane, so the surface will be curved to match the surface of the Earth. This is the most accurate model to use so that water sits at an equal depth across a field.
- Contour: The system guides you around a contour and indicates whether to drive up or down to maintain your current level. This is designed for marking rice levees.

For cabling information, see FM-1000 Integrated Display Cabling Guide.

For operational information, see Leveling (page 396).

Implement settings for FieldLevel II

1. At the *Home* screen, tap .
2. At the *Configuration* screen, tap FieldLevel II and then tap **Diagnostics**.
3. At the *Field Level Diagnostics* screen, use the Height Control options to set the target height.
4. You can test valve functionality at any time at this screen without the need for a GPS position or an active field design open. See FieldLevel II diagnostics valve test (page 460).

GPS receiver setup

The FieldLevel II system uses its own GPS receiver to record the exact position of the leveling blade. To configure this receiver:

1. At the *Configuration* screen, select the GPS Receiver that is associated with FieldLevel II and then tap **Setup**. The *WM-Drain GPS Receiver Settings* screen displays.
2. From the Receiver list, select the GPS receiver you will use for your FieldLevel system. It is recommended that you tap **Internal Primary** when configuring the display as a stand-alone FieldLevel II system, but you can use an external GPS receiver. If you are also using the Autopilot system, it is recommended that you use **Internal Secondary**, as the Autopilot system will be occupying the Internal Primary receiver.
3. From the Corrections list, select RTK for all FieldLevel II applications.
4. Set the Network ID to the same network ID that is set in the base station receiver.
5. Tap **OK**.
6. FieldLevel II is now configured and ready to use.

FieldLevel II settings

Complete the FieldLevel II settings:

- Settings tab (page 270)
- Blade Settings tab (page 272)
- Relative Heights tab (page 272)
- Valve Setup tab (page 273)
- Height Filter Tab (page 273)

Settings tab

1. At the *Configuration* screen, select FieldLevel II and then tap **Setup**. The *FieldLevel II Setup* screen displays.
2. Select the Settings tab and complete the settings.

Setting	Explanation
Operation Mode	Choose your leveling model. • Point and Slope: Creates consistently sloped tile or surface drainage. • Multiplane design: Uses more complex surface designs imported from the MultiPlane design software. • Plane (Flat): Levels the field to a design plane. The plane can be configured in the on-board software using benchmarks and slopes, or by creating a plane of best-fit over a surveyed surface (Autoslope). This leveling model uses a high-accuracy GPS receiver mounted on the leveling implement. However, the design heights are corrected to a plane surface to match your old laser-leveled fields. • Plane (Earth Surface): Levels the field to a design plane. The plane can be configured in the software using benchmarks and slopes, or by creating a plane of best-fit over a surveyed surface (Autoslope). It uses a high-accuracy GPS receiver mounted on the leveling implement. • Contour: Uses the FM-1000 integrated display's on-screen lightbar (or an LB25 external lightbar) to guide the vehicle along contours to keep the vehicle at the same elevation. This can be used for levee marking and applications that require guidance to elevations.
Cut/Fill Range Warning	Acceptable warning distance. When Auto mode is engaged and the blade is outside this range for more than three seconds, a warning displays.
VDOP Level	Vertical Dilution of Precision: A measure of the vertical accuracy of the GPS signal. If the VDOP reaches this value, a warning message displays. A VDOP setting of less than 3 is recommended.
Correction Age Timeout	
On Grade Tolerance	Tolerance for a cut / fill value being considered on grade. The On Grade Tolerance is shown as the green color in the Cut /Fill scale. If a value of 0.5' is used for the on grade tolerance, any value between 0.5' of cut and 0.5' of fill will show as green on the Cut / Fill map.

Blade Settings tab

Setting	Explanation
Blade Step	The increment that you require the blade to move each time it is stepped up or down by the plus or minus offset buttons.
Course Blade Step	Coarse mode enables you to offset the target height in large increments with a single tap, such as a 0.2' fill. The increment you want the blade to move each time it is stepped up or down in Coarse mode.
Antenna Height	Height of the antenna above the lower edge of the blade.
On-grade Limit	Distance the blade can move before the green blade height indicators change to thin red arrows. At twice this distance, the height indicators become thick red arrows. See Blade Settings tab (page 272).
Disengage Raise	When you disable Auto while scraping a field, you can set a time value that will automatically raise the blade. For example, if you set 0.5s, the blade will raise for half a second when you turn off Auto mode.
Remote Input Auto	You can attach a remote for enabling and disabling Auto mode. This remote is controlled with the Remote Input Auto setting.

Relative Heights tab

For survey data collection or field leveling, set relative the relative offset height so that the coordinates are recorded relative to the offsets set for the master benchmark.

Setting	Explanation
Relative Heights	Enabled: For relative heights from the master benchmark Disabled: For GPS heights at all times
Relative X	The X coordinate that will be applied to the master benchmark if relative heights are enabled.
Relative Y	The Y coordinate that will be applied to the master benchmark if relative heights are enabled.
Height Offset	The height value that will be applied to the master benchmark if relative heights are enabled.
Force Re-Bench	If set to Yes and the field has been closed and opened again, the system will not let you begin work again until you have re-benched. Use this setting if you are using a different base station setup between work sessions.

Setting	Explanation
	If you have a permanent base station setup that is never moved, select No. The system will not force you to rebench.

To view relative offset values on the *Run* screen, set the offsets as status text items on the slide-out tab. See Status items (page 64).

Valve Setup tab

Setting	Explanation
Valve Module	Type of valve module that is detected
Valve Type	Select the type of valve that is connected.
Valve Inverted	Not Inverted: (Default) Keep this setting unless the tank and pressure hoses have been installed incorrectly on the valve. Inverted: Select if tank and pressure hoses have not been installed correctly. This eliminates the need to reverse the hoses.

Height Filter Tab

Choose the filter for height:

Setting	Explanation
None	This setting (this is the raw GPS data used for height) is recommended.
Average	The height will be averaged using the number of positions selected. This will smooth spikes in height readings but will introduce a latency into the controls.
Jump Detect	This will filter out some jumps in the height readings. When selected, the following values must be entered: • Threshold: The change in height value that will trigger the filter • Decay Time: After the filter is triggered, the amount of time it takes to gradually resume using the raw GPS height

Valve module calibration

Note *– Depending on the make and manufacturer of your vehicle, the tractor computer may need to be put into a special mode. Refer to the FieldLevel II Installation Guide for your vehicle type.*

1. At the *Configuration* screen, select FieldLevel II and then tap **Calibrate**. The *FieldLevel II Calibration* screen displays.
2. Set the vehicle throttle to 100%.
3. For automatic calibration, tap **Start**.

   The system performs its calibration sequence to test the speed at which the blade raises and lowers. This process takes approximately 8 – 10 minutes.
4. To manually calibrate the valve, enter values in the three Manual Calibration entry boxes and then tap **OK**.

Note *– Stopped DeadBand is the control deadband that is applied when the implement is traveling at less than 0.1 mph.*

Tandem / dual scraper setup

For improved productivity when leveling a field, the FieldLevel II system supports tandem or dual scraper implements.

With a tandem system, the second scraper is also controlled by GPS. This means that you can work in areas requiring cuts, and fill two scraper buckets before you have to empty the scrapers.

With a dual system, an antenna on each side of the scraper controls two independent cylinders. This creates a more accurate surface by controlling the height of both ends of the scraper.

Tandem scraper

The tandem scraper feature tows two scrapers, one behind the other. This type of leveling provides increased efficiency as it allows for the blade of each scraper to be controlled independently from the other. This means more dirt can be cut before you have to drive to a fill area and remove dirt from the scraper buckets.

Dual scraper

A dual scraper is single scraper with two GPS antennas, one at each end of the blade. This allows for control of the roll of the blade, giving a more accurate surface. This configuration is ideal for complex surfaces with high variability slopes.

Note *– For the FieldLevel II dual system you must use a scraper with dual hydraulic controls.*

Set up

Note *– Before you can configure the system, it must be professionally installed. For more information, contact your local reseller.*

- Implement setup (page 276)
- Prepare connections (page 276)
- Primary receiver setup (page 276)
- Secondary receiver setup (page 276)
- Tandem / Dual settings (page 276)
- Tandem / dual calibration (page 277)

Implement setup

If you have not already configured the implement, see Implement setup (page 276).

Prepare connections

If not already installed on the display, install:

- FieldLevel II
- Tandem/Dual

When installed, the *Configuration* screen will show:

- FieldLevel II with its associated GPS receiver
- Tandem/Dual with its associated GPS receiver

Primary receiver setup

FieldLevel II controls the primary receiver.

1. At the *Configuration* screen below Field Level, select the GPS receiver listed and then tap **Setup**.
2. From the Receiver list, select Internal Primary.
3. From the Corrections list, select RTK.
4. Set the Network ID field to the same network ID that is set in the base receiver.

Secondary receiver setup

Tandem/Dual controls the secondary receiver.

1. At the *Configuration* screen below Tandem/Dual, select the GPS receiver listed and then tap **Setup**.
2. From the Receiver list, select Internal Secondary.

Tandem / Dual settings

You must set up the FM-1000 integrated display to control either a tandem configuration or a dual configuration, depending upon the implement being used.

At the *Configuration* screen, select Tandem/Dual and then tap **Setup**. The *Tandem/Dual Setup* screen displays.

Setting	Explanation
Type	Tandem (Back): Default. Select to control two implements, one towed behind the other. Dual (Right): Select for a dual setup.
Antenna Height	Height of the antenna installed on either the rear implement, or the antenna installed on the right side of a single implement. Measure the antenna height vertically from the ground to the base of the antenna. ***Note*** *– For FieldLevel II, the antenna height value can be altered on the Blade Settings tab and relates to the antenna installed on either the front implement, or the antenna installed on the left side of a single implement.*
Disengage Raise	Used to control the rear implement or the right side of a single implement when Auto is disengaged. If you set it to 0.000s then the blade will not move up when you disengage. ***Note*** *– For FieldLevel II, the disengage raise value can be altered from the Blade Settings tab and relates to the front implement's blade, or the left side of the blade on a single implement.* ***Note*** *– For a tandem system, move the blade up when Auto is disengaged on both the front and back implements as you will be swapping between the two. For a dual setup with a single implement, we recommend that you have the left and right Disengage Raise values set to the same value.*

Tandem / dual calibration

When working with a tandem/dual configuration, the valve module must be calibrated for both:

- FieldLevel II: Relates to the front implement cylinder in a tandem configuration, or the left side cylinder of a single implement.
- Tandem/Dual: Relates to the rear implement cylinder in a tandem configuration, or the right side cylinder of a single implement.

Depending on the make and manufacturer of your vehicle, the tractor computer may need to be put into a special mode. Please refer to the *FieldLevel II Installation Guide* for your vehicle type.

1. At the *Configuration* screen, select Tandem/Dual and then tap **Calibrate**.
2. Set the vehicle throttle to 100%.
3. Tap **Start**.

   The system performs its calibration sequence to test the speed at which the blade raises and lowers. This process takes approximately 8 – 10 minutes.
4. To manually calibrate the valve, enter values in the three Manual Calibration entry boxes and then tap **OK**.

WM-Drain setup

1. If you have not completed implement setup, complete this before continuing.
2. At the *Configuration* screen, select WM-Survey and then tap **Setup**. The *WM-Drain Setup* screen displays.
3. Complete the settings on each tab:
   - Implement control settings (page 279)
   - Limit and increment settings (page 281)
   - Relative heights settings (page 282)
   - Valve settings (page 281)
   - Operation settings (page 282)
4. Tap **OK** when you have completed all the settings.
5. Calibrate the valve (page 287).

For operational information, see WM-Drain operation (page 410).

Implement control settings

Implement tab

At the Implement tab, enter the appropriate settings.

Setting	Explanation
Control Type	Height Control: Select if no IMD-600 slope sensor is installed, or if an IMD-600 slope sensor is being used for roll corrections only. Pitch Control: Select to allow the IMD-600 slope sensor to adjust for roll and pitch corrections. Height and Pitch: Select to allow the IMD-600 sensor to control pitch and height.
Height Gain	The amount of pitch control used to get to the target height with Pitch Control or Height and Pitch control types. • A higher number will more aggressively pitch the plow if it is off target. • A lower number will keep the plow closer to the grade and more slowly approach the target height. Default value for Pitch Control is 0.2, and for Height and Pitch is 0.0. Increase this by 0.05 increments and fine tune if the plow is not pitching enough to achieve the target depth.
Antenna Height	The distance from the antenna to the bottom of the boot.
Antenna Selection	Select the appropriate antenna from the list.
Survey Height Offset	The distance from the tip of the boot to the ground when the plow is in the survey position (height and pitch cylinders both in full up position).
Survey Point Density	The distance between the collected survey mapping points.
Slope Sensor (IMD-600)	Select the serial number of the installed IMD-600 slope sensor that is used for pitch and roll corrections. It is recommended that the IMD-600 be installed parallel to the bottom of the boot. See FM-1000 Integrated Display Cabling Guide. If the serial number is not in the list, make sure the cabling is connected to port C or port D of the display. Click **Measurements** to open the Tile Plow Measurements screen and select the appropriate settings.
Slope Transition Distance	Distance required to transition the plow to a different slope

Setting	Explanation
	increment. If you are using the Pitch Control or Height and Pitch control type, it is recommended to set this measurement to twice the length of the boot. If you are on a particularly rough ground, you can increase this distance to three or four times the boot length for smoother operation of the pitch cylinder. If you want the plow to follow the ground contours more closely, reduce this distance to the boot length.

Tile Plow Measurements

At the *Tile Plow Measurements* screen (when you are setting up Pitch Control and Height and Pitch control types), complete the settings and tap **OK**.

IMD-600 section

Setting	Explanation
Label Faces	The direction (Up, Down, Left, Right) that the IMD-600 label faces in relation to the direction the plow travels during installation.
Connector Faces	The direction (Left, Right, Forward, Back) that the IMD-600 connector faces in relation to the direction the plow travels during installation.
Pitch Offset	The amount of angle or tilt (up or down) if the sensor is not installed parallel to the bottom of the boot. If you adjust the pitch offset, this can help correct the boot pitch if it is not running level through the ground.
Roll Correction	Corrects for static roll caused by minor variations in the sensor mounting.

Antenna section

Setting	Explanation
Horizontal	The distance from the leading edge of the boot to the center line of the antenna. The horizontal distance should be positive if the antenna is forward from the tip of the boot and negative if it is backward.
Vertical	The distance from the bottom of the boot to the base of the antenna dome.
Lateral	Offset of the antenna from the center line of the pipe.

Setting	Explanation
Boot Length	Distance from where the pipe exits, to the back of the boot, to the leading edge of the boot.
Offset	The distance of the GNSS antenna from the approximate center of vehicle rotation (the fixed rear axle of a towed plow or the center of the tracks). Forward is the antenna in front of the pivot point. Backward is the antenna behind the pivot point.
Antenna Selection	Select the antenna from the list.

Valve settings

Select the Valve Setup tab and complete the settings for the PWM valve.

Setting	Explanation
Valve Module	Displays the type of valve module that is detected.
Valve Type	Select the type of valve that is connected.
Valve Inverted	Leave this value as Not Inverted unless the raise and lower hoses have been installed incorrectly on the valve. If this is the case, select Inverted to eliminate the need to reverse the hoses.

Limit and increment settings

Select the Steps tab and complete the settings.

Setting	Explanation
Height Step	Fine: You can change height steps in small increments. Coarse: You can change height steps in large increments.
Pitch Step	Fine: You can change height steps in small increments. Coarse: You can change height steps in large increments.
On-grade Limit	This limit sets the distance the blade can move before the green blade height indicators change to a thin red arrow. At twice this distance, the height indicators become think red arrows. See blade position indicators (Blade level indicators (page 404)).
Slope Adjust	This percentage controls the amount the gradient changes each time you increase or decrease the slope on the Install tab

Setting	Explanation
	when in Point and Slope mode. For example, if the leveling gradient is 3% and the Slope Adjust value is set to 2%, the leveling gradient changes to 5% if you decrease the slope.

Relative heights settings

Select the Relative Heights tab and complete the settings.

Setting	Explanation
Relative Heights	Enabled: Select to use the relative heights from the master benchmark. Disabled: Select to use GPS heights at all times.
Relative X	If relative heights are enabled, this is the X coordinate that will be applied to the master benchmark.
Relative Y	If relative heights are enabled, this is the Y coordinate that will be applied to the master benchmark.
Height Offset	If relative heights are enabled, this is theheight value that will be applied to the master benchmark.

Operation settings

Select the Operation tab and enter the settings.

Setting	Explanation
Force Rebench	Yes: If the field has been closed and then reopened, the system will not allow you to begin work until you have re-benched. Use this setting if you are using a different base station setup between work sessions. No: Select if you have a permanent base station setup that is never moved.
VDOP Level	Vertical Dilution of Precision measurs the vertical accuracy of the GPS signal. If the VDOP reaches the value you enter, a warning will display. A setting of less than 3 is recommended.
As-Built Logging	Manual: Logs data if hydraulics are engaged and if you have begun logging in the *Run* screen. Engage: Logs data only if Auto is engaged on the plow.

Setting	Explanation
Filter Type	None: Raw GPS data is used for height. This setting is recommended. Average: The height will be averaged using the number of positions selected. This will smooth spikes in height readings but will introduce a latency into the controls. Jump detect: This will filter out some jumps in the height readings. When you select this, you must enter the following values: • Threshold: The change in height value that will trigger the value. • Decay Time: When this filter is triggered, this will be the amount of time it takes to gradually resume using the raw GPS height.

Calibrate WM-Drain for cantilever plow

Follow the steps in sequence for consistent calibration results and improved performance. If you skip steps, you may experience inconsistent results.

Step 1: Select the mode

1. At the *Configuration* screen, select WM-Drain and then tap **Setup**. The *WM-Drain Setup* screen displays.
2. On the Implement tab, from the Control Type list select Pitch Control.
3. Tap **Measurements**. The *Tile Plow Measurements* screen displays.
4. Enter all measurements as accurately as possible to the nearest 0.25 inch (1 cm).
5. Tap **OK** to return to the *WM-Drain Setup* screen.
6. On the Implement tab, enter values for Height Gain and Slope Transition.
7. Calibrate the roll offset.

Step 2: Set up the system

In the Implement tab, enter the values for Height Gain and Slope Transition Distance. See Implement control settings (page 279).

Step 3: Calibrate Roll Offset

1. At the *Configuration* screen, select WM-Drain and then tap **Diagnostics**. The *Drainage Diagnostics* screen displays.
2. Complete the roll offset calibration using one of two methods.

Method 1

1. Park the system on a known level surface. Ensure the boot is flat on the ground.
2. Note the Roll value on the *Drainage Diagnostics* screen.
3. At the *Tile Measurements* screen, for the Roll Correction value enter an offsetting value.

   For example:

   - Current angle reading = .07°
   - IMD-600 Roll reading = -0.2°
   - Roll Offset = 0.9°
4. Return to the *Drainage Diagnostics* screen. Wait approximately 30 seconds for the filtered reading to settle on a stable value.
   - If the Roll value is ± 0-0.1°, the roll offset calculation has been calibrated correctly.
   - If the Roll value is not ± 0-0.1°, note the value and then repeat Step 3 to enter a value that corrects for any remaining error.

   For example:

   - Current angle reading = .07°
   - IMD-600 Roll reading = 0.5°
   - Increase Roll Offset by 0.2°. Roll Offset now = 1.1°

Method 2

1. Park the system on a known level surface. Ensure the boot is flat on the ground.
2. Place a digital angle indication device flat against a smooth surface on the side of the system's boot shank. Note the roll angle of the boot shank.
3. Note the Roll value that displays on the *Drainage Diagnostics* screen.
4. At the *Tile Measurements* screen, for the Roll Correction value enter an offsetting value.

   For example:

   - Shank angle reading = 4.7°
   - IMD-600 Roll reading = 2.5°

- Roll Offset = -2.2°

5. Return to the *Drainage Diagnostics* screen. Wait approximately 30 seconds for the filtered reading to settle on a stable value.
   - If the Roll value is ± 0-0.1° of the measurement taken in Step 2, the roll offset calculation has been calibrated correctly.
   - If the Roll value is not ± 0-0.1°, note the value and then repeat Step 2 to enter a value that corrects for any remaining error.

   For example:
   - Shank angle reading = 4.7°
   - IMD-600 Roll reading = 4.5°
   - Increase Roll Offset by -0.2°. Roll Offset now = -2.4°

Step 4: Calibrate the valve

Perform an automated valve calibration to provide the best valve drive performance. See Valve module calibration (page 273).

Step 5: Tune system performance

The system gains may need to be fine tuned to reach the desired level of system performance.

1. Set the tractor hydraulics to ~70% of the maximum flow. This will allow you to fine tune the hydraulics without adjusting any other calibration settings.
2. Walk beside the system while operating a dry run. This allows you to see the visual cues necessary for efficient gain adjustment. Pay close attention to the cylinder movement and note any directional trend.

   Excess movement in both directions can indicate the following:
   - Hydraulic flow is too high. It is recommended that you drop the flow by 5% and then recheck.
   - Drop both valve gains by 5% and then check for improved performance.

   Excess movement in one direction can indicate:
   - Valve gain in that direction (raise or lower) is too high. Drop the corresponding valve gain by 5% and then check for improved performance.
   - Valve gain in the opposite direction (raise or lower) is too low. Raise the corresponding valve gain by 5% and then check for improved performance.

Step 6: Set the height gain

Fine tuning the height gain and the overall valve gains are a crucial step in perfecting the precision control of a cantilever plow with the WM-Drain system.

In the Implement tab, adjust the Height Gain values:

1. Manually drive the plow to a depth below the optimal depth of the section line that you have surveyed and designed for this calibration run. The system will default to a Height Gain of 0.2.
2. Move forward at the speed and RPM that you will be running the plow. When the vehicle is moving, engage the WM-Drain system and note how quickly the system takes to get to the design depth.

   Note *– The system may not go the optimal depth that you have entered at this time because the pitch offset of this plow has not been determined. In this test, the system should drive to a consistent depth each time it is engaged.*
3. If the system is too lazy/slow to get to depth within a reasonable distance, increase the height gain setting by a value of 0.05. Continue to raise this value until the plow achieves depth at the required speed.

   Note *– The plow may oscillate while on grade.*
4. Split the last two values you entered.

   For example:

   - Height Gain run prior = 0.300
   - Height Gain current run = 0.350
   - Height Gain to try next run = 0.325

   Note *– After you have determined the optimal values for a particular plow series, such as Liebrecht 5' plow, it is very likely that you can enter the same measurements, offsets, and height gain values for other plows of the same series. With a good valve calibration for each plow, you should be able to get each subsequent plow running very quickly.*

Determine the pitch offset

Note *– It may take some time to determine the proper pitch offset of a plow accurately.*

Without a correct pitch offset, the system will most likely attempt to maintain the design slope and drive the plow above or below the optimal depth.

All cantilever plows must assume an angle that is slightly tipped up in order to maintain depth against the immense down-pressure being applied by the soil that is being displaced. If the boot traveled through the soil with an even attitude the plow would progressively plow deeper as it was pulled through the soil.

After the pitch offset value has been determined, the value should only change as the tip begins to show considerable wear.

Note *– Before completing this process, ensure that the system drives to a consistent depth. This depth may not be the optimal depth, but it will ensure that the hydraulic system is operating well. Once you are certain that optimal performance has been achieved, you may begin the process of determining the proper pitch offset with consistent results.*

1. Engage the plow on a newly surveyed section line in soil that has been undisturbed.
2. Allow the system to drive the vehicle to a consistent depth and then begin entering a positive

Pitch Offset value in the Implement tab. Enter values in 0.50% increments.

Note *– It may take 1-2 lengths of the boot for the system to fully recognize this offset.*

3. Continue the actions in Step 2 until you are within a few hundredths of optimal depth.
4. Allow the system to drive along the entire section line. Ensure that the system continues to be consistent through any transitions that are found in the current section line.
5. When you believe the system is running with the highest accuracy possible, survey another new section line. Allow the system to drive the entire line.
6. Repeat Step 2 through Step 4 until the system gives a consistent result. Note the pitch offset value you came up with and reset the run screen offset back to 0.00%.
7. At the *Measurements* screen, enter the determined Pitch Offset value.

   Note *– Once determined, this value should only change once the tip begins to show signs of considerable wear*

Calibrate the valve

WM-Drain performs its calibration sequence to test the speed at which the blade raises and lowers. This process takes approximately 8 - 10 minutes for each valve.

1. At the *Home* screen, tap . The *Configuration* screen displays.
2. Select WM-Drain and tap **Calibrate**.
3. Select the appropriate valve (depth or pitch), if applicable.
4. At the *Depth Valve Calibration* screen, set the vehicle throttle to 100% and tap **Start**.

   Note *– To manually calibrate the valve, enter values for manual calibration and tap* **OK**.
5. When the procedure is complete, tap **OK**.
6. Repeat this procedure for another valve, if applicable.

Note *– To stop the plow cylinders from working excessively when stopped, you can add a value for Stopped Deadband.*

CHAPTER 17

Yield Monitoring setup

In this chapter:

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Map settings **297**
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Yield sensor / moisture sensor calibration **297**
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Yield Monitoring obtains data from mass, flow, and moisture sensors to gather data and define high and low productivity areas of a field during harvest.

Yield Monitoring functionality

Yield Monitoring enables you to accurately view, map, and record crop yield and moisture data in real-time during harvest to immediately understand how well your crop performed.

Supported yield monitoring types range from EOM sensors (both CAN and Serial) to Trimble's full Yield Monitoring CAN solution.

Yield Monitoring functions include:

- Variety tracking (page 429): Map and compare the performance of different seed varieties throughout your field.
- Moisture tracking: Determine if grain needs to be stored or dried based on the in-field moisture content.
- Load tracking (page 430): Record the amount of grain harvested and loaded onto your trucks.
- Auto-cut width adjustment: Adjust the cut width automatically when traveling over odd-shaped fields, point rows, or other previously harvested areas to improve the accuracy of yield calculations.

Yield Monitoring best practices

There are key practices required to use the Yield Monitoring system to best advantage. Read this before you start the installation and setup procedures.

Installation

The Yield Monitoring System relies on an appropriate installation of the optical sensors. To ensure the best results:

- Install the optical sensors in the location described in the *Installation Guide*.
- If the desired location is not achievable, install the optical sensors as high as possible, but no more than 6 inches (15 cm) below the top spindle of the elevator.
- Installing the sensors lower than 36 inches (90 cm) above the bottom spindle will give unacceptable results.
- Interference: Ensure that there is no opportunity for interference between the optical sensors or the retaining brackets and any moving parts on the combine. Be especially aware of chains, belts, pulleys, and tensioning rods, and keep in mind that their range of motion may be much greater during operation than when standing still.
- Alignment: Ensure that the optical sensors will not move out of alignment during operation.
- Paddle support bracket: Ensure that the optical sensors will not sense the paddle support bracket. Refer to the *Installation Guide* for more information.

Tare calibration

The quality of the Tare Calibration is critical to getting good accuracy, particularly at low flow rates. To ensure the best results:

- Check the tare daily.
- When performing the tare calibration, run the system at the same speed as you would normally use during operation.
- While running the system empty, look at the elevator speed. This number must be correct, typically between 12–20 Hz.
- Run the tare calibration. The tare value represents the measured thickness of the paddles, and should be approximately correct. It is more important that the number is consistent than that is exactly right.
- If the measured value is considerably higher than expected, check the entered values for paddle spacing, and check that the optical sensors are not being obscured by the support brackets on the paddles.

- If the measured value is considerably lower than expected, recheck the entered paddle spacing and the elevator speed. If both are correct, low tare should not be a problem.
- Tare Deviation indicates how much variation there is in the measurement of the paddle size. Normally, this number should be less than ¼ the size of the paddle itself. If this number is excessively large, check the installation for interference or opportunities for excessive vibration, like a poorly-tensioned elevator chain.

Flow calibration

Calibrating the Yield Monitoring system across the full range of flows will improve the accuracy of the system. To get a good calibration, do the following:

- Select calibration loads where the:
  - Conditions are consistent
  - Crop quality is even
  - Ground is as level as possible
  - The passes are as long as possible.

  Keep the combine speed constant during the entire run.
- Collect loads that are as large as is practical without sacrificing consistency.
- Collect as many different calibration loads as possible, with each load at a different flow rate. To accomplish this, you can run the system at different speeds, or harvest partial header widths.
- If you still have significant errors in the calibrations, check the noise level during harvesting. If this figure is above 30%, check for interference with the optical sensors, or opportunities for excessive vibration. If your paddles are very worn, they may need to be replaced.

Pitch/Roll calibration

The Yield Monitoring system corrects for the pitch and roll of the combine. To benefit from this feature, perform the pitch/roll calibration as described in the owner's manual.

The system has correction parameters for each tilt direction that you can adjust to improve performance. Use the following table when you decide how to adjust these parameters.

Note *– The pitch sensitivity adjustment depends on whether your sensor is mounted in front of or behind the center of the paddle.*

Tilt angle	Yield reading too high	Yield reading too low
Left roll	Increase left roll sensitivity	Decrease left roll sensitivity
Right roll	Increase right roll sensitivity	Decrease right roll sensitivity
Backward pitch, sensor	Decrease backward pitch	Increase backward pitch

Tilt angle	Yield reading too high	Yield reading too low
forward of center	sensitivity	sensitivity
Backward pitch, sensor aft of center	Increase backward pitch sensitivity	Decrease backward pitch sensitivity
Forward pitch, sensor forward of center	Increase forward pitch sensitivity	Decrease forward pitch sensitivity
Forward pitch, sensor aft of center	Decrease forward pitch sensitivity	Increase forward pitch sensitivity

To start, adjust the sensitivity numbers in increments of 0.2.

Test weight

The Yield Monitoring system measures the volume of grain passing through the combine, and estimates the weight by multiplying the measured volume by the test weight. Therefore, an accurate measurement of test weight is required in order to achieve an accurate total weight measurement. To ensure the best results:

- Recheck the test weight whenever the field conditions change significantly, either when harvesting different varieties, or when the moisture level of the crop changes.
- Take several samples of test weight on calibration loads, and use the average of these samples when calibrating.

Calibrating and operating conditions

How you operate your combine can affect your accuracy. Consider the following:

- Calibration will be most effective if you operate your combine at the same conditions as you used during calibration.
- Frequent starts and stops during a load could degrade the overall accuracy of the load.

Yield Monitoring settings

The following yield monitoring systems are supported:

- Trimble Yield Monitoring
- Various supported OEM moisture sensors
- Claas, 670 and 700 series (***North America only***)
- John Deere, -60 and -70 series
- Serial data input

Before setup

Before setting up Yield Monitoring, make sure:

1. All components are installed on the vehicle. Refer to the *Installation Guide* that is shipped with every Yield Monitoring kit.
2. Yield Monitoring has been added to the display's configuration. See .
3. The implement has been set up and configured for the appropriate operation. See Implement setup (page 138).

Setup steps

To complete the setup for Yield Monitoring:

1. Choose the combine and complete its settings. See Combine settings (page 294).
2. Complete the Operation settings (page 295).
3. Enter the Crop settings (page 296) for your crop.
4. Complete settings for the map legend. See Map settings (page 297).
5. Complete the Sensor output settings (page 297).
6. Complete the Options settings (page 297).

Combine settings

At the *Yield Monitoring Setup* screen on the Setup tab, enter information about the harvester you are using.

Setting	Explanation
Combine	Make of harvester
Series	Series of combine
Yield Monitor Type	Type of Yield Monitoring: • Trimble YM (Yield Monitoring) • Claas • John Deere • Serial Data Input
Port Connection	The port on the back of the FM-1000 integrated display that the yield monitor is connected to
Moisture Sensor	Moisture sensor you are using: • Trimble • Case IH • New Holland • AGCO • Ag Leader
Advanced Setup	

Operation settings

At the *Yield Monitoring Setup* screen on the Operation tab, enter information about the combine you are using.

Note *– The selections available on the Operation tab may vary depending on the yield monitoring type that you selected.*

Setting	Explanation
Header Height Sensor	Enabled: The sensor is enabled. Disabled: The sensor is disabled.
Head Logging Height ***Note*** *– Not available for the Claas 600/700. This is set by the CEBIS.*	The height at which yield data logging starts and stops. The Head Logging Height is read from the Header Height Sensor. If required, tap **Current Height** to enter values related to your own setup.
Grain Flow Delay	Time (in seconds) it takes for the grain to reach the yield sensor after it

Setting	Explanation
	enters the head
Reset Autocut	Controls when the rows are automatically reset • When head is lifted: Automatically resets the rows at the end of the row when the head is raised above the logging height • Never: Disables autocut. Rows must be controlled manually.
Crop Overlap	When more than one crop variety is detected in the head, the system will stop accumulating variety statistics. Use this setting to adjust the percentage of crop overlap that is allowed before the system stops accumulating variety statistics. Select a value between 1% and 25%. For best results, the recommended setting is 10%.

Crop settings

At the *Yield Monitoring Setup* screen on the Crop tab, enter the settings for your crop.

Setting	Explanation
Commodity	Select the crop that is currently being harvested
Units	Select the unit of measure for the crop type: • Bushels/acre • Lbs/acre • Tons/acre • Hundred Weight/acre (When this is selected, the Bushel Weight field is automatically set to 100 lbs.) • Bushels/hectare • Kgs/hectare • Tonnes/hectare
Standard Bushel Weight	Enter the weight of a single bushel of crop.
Storage Moisture	Set the cutoff point between a wet crop and a dry crop. Set these values depending on what you want the map to look like.
Moisture Upper Limit	Range from 5-40%. The working limit of the sensor if a trimble moisture sensor is attached.

Map settings

At the *Yield Monitoring Setup* screen on the Map Legend tab, enter information about the yield and moisture values to display on the *Run* screen.

Setting	Explanation
High Yield	Highest expected yield for the current event
Low Yield	Lowest expected yield for the current event
High Moisture	Highest expected moisture for the current event
Low Moisture	Lowest expected moisture for the current event

Sensor output settings

At the *Yield Monitoring Setup* screen on the Serial tab, enter what output you want from the sensors.

Setting	Explanation
Baud Rate	Modulation rate of data transmission in seconds
Parity	• None: No parity bit sent • O: Odd parity bit • Event: Even parity bit • Mark: Parity bit is set to mark signal condition • Space: Party bit is set to space signal condition
Data Bits	Number of data bits to transmit
Stop Bits	Number of bits that represent the stop message. Used to identify the end of the cropping message when transmitted by the system.

Options settings

At the *Yield Monitoring Setup* screen on the Options tab, select the setting for New/End Load Confirmation.

Yield sensor / moisture sensor calibration

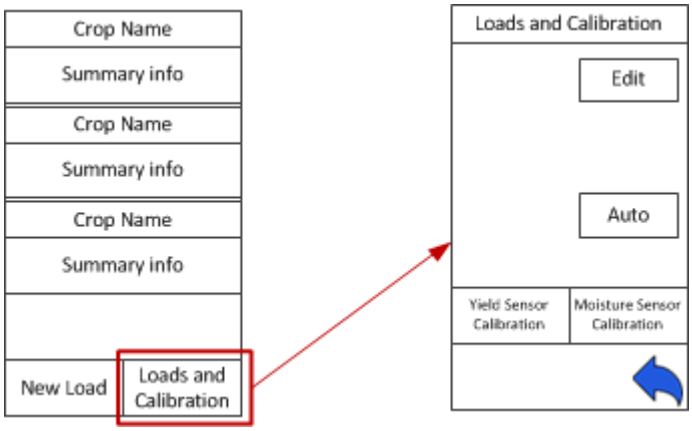
To calibrate the yield sensor and moisture sensor, use either of these:

- Single-Load Calibration
- Multi-Load Calibration

Before starting either procedure, keep the following in mind:

- Use the same load type for both yield and moisture calibration.
- To achieve the highest accuracy, perform the Multi-Load Calibration procedure.

Calibration steps



1. Verify that all Yield Monitoring setup parameters are correct.
2. At the *Run* screen, tap to open the Yield Monitoring panel.
3. Tap **Loads and Calibration**. The Loads and Calibration view of the panel displays.
4. Tap either **Yield Sensor Calibration** or **Moisture Sensor Calibration**, depending on which calibration you want to perform.
5. Calibrate the Header Height.
6. Calibrate the Temperature.
7. Calibrate the Roll Offset.
8. Calibrate the Yield Sensor Tare.

   If the Average Tare Deviation is equivalent to or greater than the thickness of the elevator paddle, the system may encounter a large amount of noise. “Noise” can be introduced into the system by any of the following factors:

   - Paddles contacting the Yield Sensor optical lens
   - Yield Sensor optical lens obstructed
   - Yield Sensor(s) loose
   - Elevator chain with excessive slack or paddles flopping up/down

- Tensioning rod contacting yield sensors
- Excessive paddle wear causing large quantities of grain to fall back down the elevator between the elevator wall and the outside of the paddles

9. To check the noise percentage of the system, turn the combine separator on at full engine RPM and then select Yield Monitoring / Diagnostics / Status to see the noise percentage. If this is very high, check the aspects listed.

   Note *– If the frequency deviation is high, you may have an inconsistent Elevator RPM and may need to inspect the performance of your clean grain elevator pulleys, bearings, chain, and so on.*

10. Select either method for calibration:
    - Speed method: Uses a consistent speed variable to calibrate for Low, Medium, and High flows.
    - Cut Width method: Uses a consistent cut width variable to calibrate for Low, Medium, and High flows.

Speed method

1. Conduct a calibration load of 3,000-6,000 lbs. at your normal constant speed.
2. Repeat this procedure for:
   - One load at 1 mph less than the normal operating speed
   - One load at 2 mph less than the normal operating speed
   - One load at 1 mph higher than the normal operating speed

   This provides a calibration curve for Low, Medium, and High flow variations throughout the course of harvest.

An example of calibration loads using this method is as follows:

- Load 1 = 4,547 lbs. @ 4 mph
- Load 2 = 3,834 lbs. @ 3 mph
- Load 3 = 2,764 lbs. @ 2mph
- Load 4 = 5,768 lbs. @ 5 mph

Cut width method

Note *– It is highly recommended that you conduct a minimum of three calibration loads to ensure that the system provides accurate readings for all low, medium, and high flows throughout harvest. If you conduct a Single Load calibration, this may result in poor accuracy performance when Harvesting outside the Flow range at which the system was initially calibrated.*

1. Conduct a calibration load of 3,000-6,000 lbs. at your normal constant speed with a 100% cut width (12 rows at 30 ft).
2. Repeat this procedure for:
   - One load at 75% of the normal cut width (8 rows at 20 ft)
   - One load at 50% of normal cut width (6 rows at 15 ft)
   - One load at 25% of normal cut width (3 rows at 7.5 ft) at the same constant speed

   This provides a calibration curve for Low, Medium, and High.

   Flows vary throughout the course of Harvest.

   An example of calibration loads using this method is as follows:
   - Load 1 = 5,768 lbs. @ 4 mph @ 100%
   - Load 2 = 4,547 lbs. @ 4 mph @ 75%
   - Load 3 = 3,834 lbs. @ 4 mph @ 50%
   - Load 4 = 2,764 lbs. @ 4 mph @ 25%
3. At the *Yield Sensor Calibration* screen for each load:
   a. Enter the actual scale weight.
   b. Enter the actual test weight (average of a minimum of three test weight measurements).
   c. Select each load for which the actual weight and test weight will be calibrated.
   d. Tap **Update Calibration**.
   e. Tap **Apply Calibration**.
4. At the *Moisture Sensor Calibration* screen for each load:
   a. Enter the actual moisture.
   b. Select each load for which the actual moisture will be calibrated.
5. Tap **Update Calibration**.
6. Tap **Apply Calibration**.

Third-party display instructions

Claas Cebis Quantimeter setup

Note *– When using Yield Monitoring with Claas Quantimeter, always set Autopilot Coverage Logging to manual. See* *Engage settings for Autopilot system (page 148)**.*

Crop Harvested setting

1. On the Cebis display, tap and then tap .
2. Tap and then select the crop that you are harvesting.

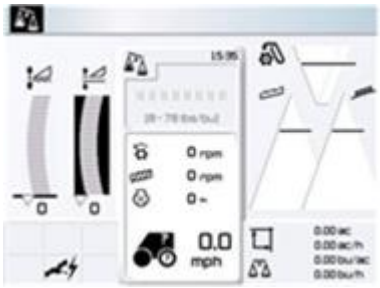
Moisture Measuring setting

1. Tap and then tap .
2. Tap and then adjust the following settings:
   - Status
   - Moisture correction
   - Display of yield with storage moisture
   - Adjust storage moisture
   - Display of current moisture

Bulk Density setting

1. Turn the HOTKEY dial to the scales icon.

2. Adjust the crop density by rotating the HOTKEY until the correct value displays on the screen.



Note *– The lbs/bu value must be set before the Weight Measured function can be used.*

Zero Yield setting

1. Tap and then tap .
2. Tap and then tap .
3. Tap **OK**.

Zero Angle setting

1. Tap and then tap .
2. Tap and then tap .
3. Tap **OK**.

Claas Cebis Quantimeter calibration

1. Tap and then tap .
2. Tap and then scroll to **On**.
3. Harvest a full grain tank or truck load.
4. After the tank or truck is full, tap and then tap .
5. Tap and then scroll to **Off**.
6. Weigh the grain tank or truck to get a scale ticket.
7. Tap and then tap .
8. Tap and then tap Crop yield weighted.
9. Scroll to increase or decrease the value until it matches the weight on the scale ticket.

Claas Cebis Auto Pilot calibration

Activate the AutoPilot system

1. Tap and then tap .
2. Tap and then scroll to On.

Steering angle and steering system setup

1. Tap and then tap .
2. Tap and then tap .
3. Tap Learning sensing system.

Centralizing switch setup

1. Tap and then tap .
2. Tap , scroll left or right to adjust the central position and then select **OK**.

Steering sensitivity setup

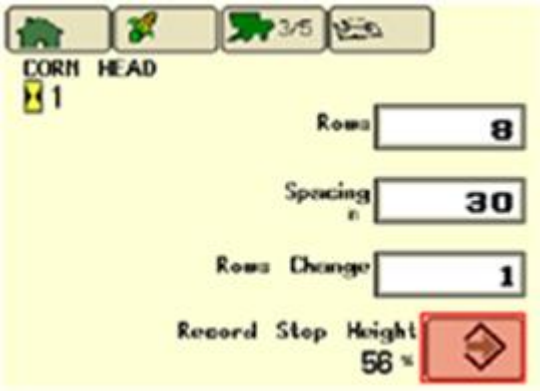
1. Tap and then tap .
2. Tap , scroll left or right to adjust the steering sensitivity and then select **OK**.

Greenstar Monitor: Stop Head Height setup

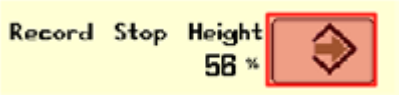
1. Tap SETUP.
2. Tap Harvest Monitor for Harvest Monitor.
3. Position the header to 100%.
4. Tap Record Stop Height 50.0% Save next to Record Stop Height.

Stop Head Height on the Command Center

1. Navigate to Home screen on the Command Center.
2. Tap the *Combine* icon in the lower right corner of the screen.
3. Tap the third button from the left on the command center to select the *Combine* tab.
4. After *Combine* tab is selected, continue to press the third button from the left until page 3 displays *(page numbers are located on the Combine Tab)*.



5. Position the header to 100%.
6. Press **Enter** on *Stop Head Height* screen to record the required stop header height.



Greenstar Monitor calibrations

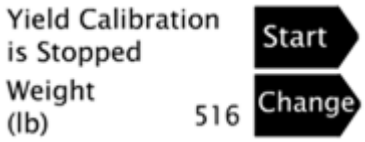
Original Greenstar Display (60 Series Combines)

Moisture calibration

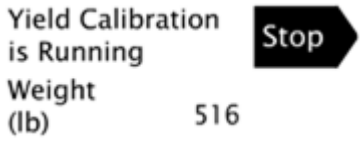
1. Press SETUP.
2. Select Yield Monitor .
3. View page 1.
4. Check moisture with a certified tester.
5. Calculate moisture correction *(certified tester reading minus the Greenstar reading)*.
6. Input the moisture difference.

Yield calibration

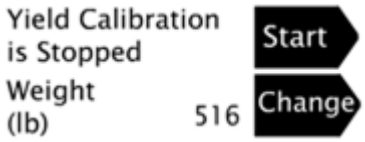
1. Press SETUP.
2. Tap Yield Monitor .
3. View page 2.
4. Verify that the combine's grain tank and the truck/wagon are both empty, and tap **Start**.



5. Harvest about 500 bushels, and hit **Stop**.



6. Unload the grain harvested during calibration onto truck/wagon.
7. Select button next change to enter the weight of the truck/wagon in wet pounds.



Command Center (70 Series Combines)

Moisture calibration

1. Navigate to Home screen on the Command Center.
2. Tap .
3. Press on the Command Center.
4. Continue to press until page 2 displays (page numbers are shown on the Wrench tab).
5. In the *Calibrations* list, select Moisture.

6. Follow the steps to perform the calibration.
7. Highlight the arrow and then press the *Confirm* switch on the armrest.

Yield calibration

Navigate to the Home screen on the Command Center.

1. Tap .
2. Press on the Command Center.
3. Continue to press until page 2 displays (page numbers are shown on the Wrench tab).
4. In the *Calibrations* list, select Yield.

5. Follow the steps to perform the calibration.
6. Highlight the arrow and press the *Confirm* switch on the armrest.

Update the Moisture Sensor (60 Series combines only)

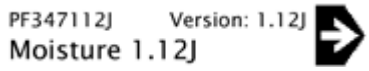
Obtain version 1.20C from Stellar Support

1. Go to www.stellarsupport.com.
2. Tap *Support & Downloads* in the left column.
3. Tap *Greenstar System* update from the *Software Downloads* column.
4. Select the green box labeled *Download GSD4 Software*.
5. Tap **Run** in the file download security warning.
6. After the download is complete, choose the preferred language and press **OK**.
7. Follow the Greenstar Update Wizard to load the firmware to the keycard for the original Greenstar monitor.

Load version 1.20C to the Moisture Sensor

1. Insert the updated keycard into the mobile processor that is hooked to the Greenstar display *(it does not matter which slot the keycard is inserted in on the mobile processor)*.
2. Power on the Greenstar monitor.
3. Press INFO.
4. Tap KeyCard .
5. Tap Program Target .

6. Tap

.
7. Tap 

.
8. Disconnect the mobile processor after the update is complete.

CHAPTER 18

Operations

In this chapter:

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Field feature use **322**
Guidance pattern use **323**
Coverage logging **343**
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Manual guidance operation **358**
Autopilot system operation **359**
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This chapter covers common user work operations preformed at the *Run* screen.

Operations overview

The *Run* screen is where you perform operations. Depending on the features you are using, additional feature buttons will display on the right-hand side of the *Run* screen.

When you begin operations, there are some basic steps you will always perform. If you have already entered implement and vehicle settings:

1. Select a vehicle and an implement.

   See Vehicle selection (page 321) and Implement selection (page 320).
2. Select or create client, farm, field and event.

   See Fields (page 319).
3. At the *Run* screen:
   a. Select or create guidance patterns and lines.

      See Guidance pattern use (page 323).
   b. Optionally add field features.

      See Field feature use (page 322).
4. Optionally activate coverage logging.

   See Coverage logging (page 343).
5. When you are finished, close the field.

   See Close a field (page 321).

Operation basics

The process of beginning operation can include:

1. Create or select a field. See Field creation / selection (page 319).
2. Select a vehicle. See Vehicle selection (page 321).
3. Select an implement. See Implement selection (page 320).
4. Load or create a guidance pattern to use. See Guidance pattern use (page 323).
5. Optionally, create field features on-screen to indicate their location in your field. See Field feature use (page 322).
6. Optionally, activate coverage logging. See Coverage logging (page 343).
7. Close the field when operations in that field are complete. See Close a field (page 321).

   The system saves an event summary of what has been done in the field. If you want the field to close more quickly, you can change the settings so that you do not save an event summary. See Event summary adjustment (page 321).

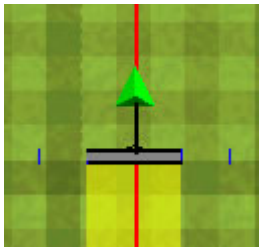
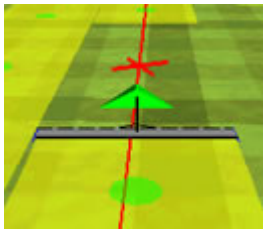
Main buttons

The main buttons on the *Run* screen enable you to:

- See the status of items
- Change the view
- Open feature panels
- Navigate to other screens
- Control automatic steering, if applicable
- Turn coverage logging on or off, if applicable

Left side of *Run* screen

Button/Indicator	Explanation
GNSS Status	Provides information about GPS. If the GPS signal is lost completely, a warning displays and this button turns red. Tap to view GNSS status (page 318).
Overhead view	In the Operational view (page 314) of the *Run* screen, shows an overhead view of the field, with the vehicle in it.

Button/Indicator	Explanation
	
Trailing view	In the Operational view (page 314) of the *Run* screen, shows a three-dimensional representation of the field from the driver's perspective. 
	Information configured using the Status items (page 64) menus.
Zoom / Pan	Opens the zoom and pan controls for the Operational view (page 314). With the pan function, you can view the field outside of the normal viewing area. To pan around the field, tap one of the four arrows positioned at the edge field area. To zoom in and out, tap either plus or minus

Button/Indicator	Explanation
	Note *– To toggle the zoom feature on or off, tap the field area of the Run screen.* The fifth level of zoom in the pan view is a summary view of all your coverage. It adjusts, depending on the size of the field. It does not include grid lines. **Tip** – If you close the field, create a second field and then show the summary view, the summary view may be zoomed to show the area of both fields. To avoid this, reboot the display. The view will be correct.
	Tap to see a listing of all optional features/plugins and their description.
xFill icon	xFill is activated, displays in the top left: • Blue: Engaged and has been used between 0 - 15 minutes • Red: Engaged and 5 minutes remain

Right side buttons on *Run* screen

The following buttons are the standard buttons on the right that are always available.

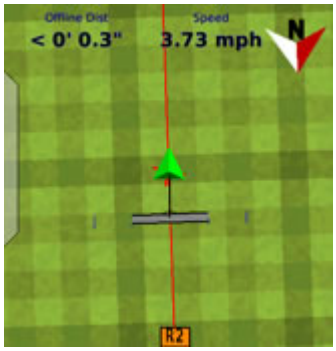
Item	Explanation
 Home	If you are at the *Run* screen and have a field open, tap to close the field and return to the *Field Selection* screen. See Close a field (page 321).
 Settings	Tap to go to the *Configuration* screen. See Configuration screen (page 33).
 Mapping guidance	Tap to open the Mapping Guidance panel. See: • Feature panels (page 314) • Guidance pattern use (page 323) • Guidance settings (page 52)

Also see:

- Coverage logging (page 343)
- Engage button (page 317)

Operational view

The operational section of the *Run* screen shows your guidance lines and an on-screen representation of your vehicle in the field. Hashed grids provide a measure of distance. Each small square represents 10 feet, and each dark green outline represents 50 feet.

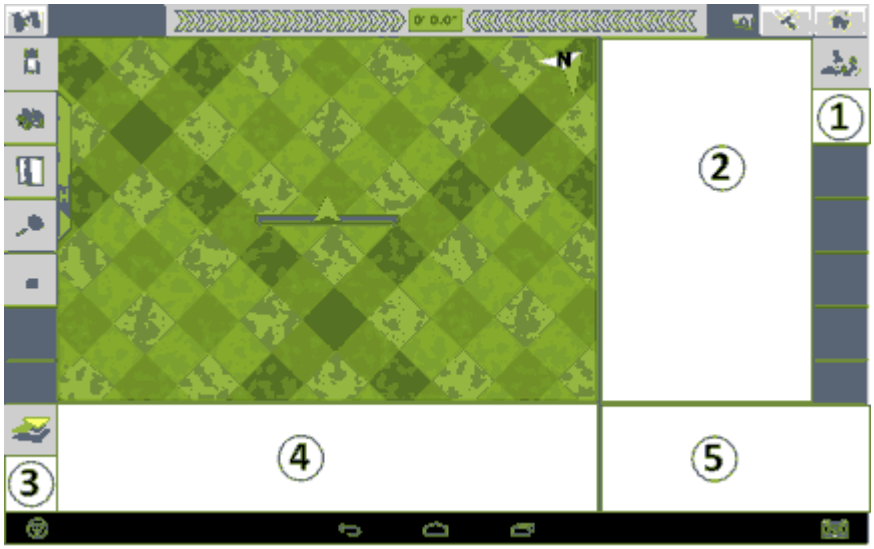


You can change your view from an overhead view to a trailing view. See Main buttons (page 311).

Feature panels

On the *Run* screen, you open a feature panel to view controls related to that feature. The feature buttons display on the right-hand side of the screen.

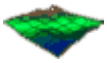
One feature is always on the *Run* screen: opens the Mapping Guidance panel.



Item	Explanation
1	Location for feature buttons. Tap to open the feature panel.
2	Feature panel. Contains controls specifically related to the feature.
3	Optional control button. Tap to open additional views related to the feature.
4	Additional information related to the feature.
5	Area for controls such as the coverage logging and **Engage** button when applicable. See: • Coverage logging (page 343) • Engage button (page 317)

Feature / plugin buttons

Button	Opens the feature panel for...
	TrueGuide implement control system. See Using TrueGuide (page 387).
	Autopilot automatic steering system. See Autopilot system operation (page 359).
	EZ-Pilot automatic steering system. See EZ-Pilot system operation (page 362).
	EZ-Steer automatic steering system. See EZ-Steer system operation (page 365).
	Field-IQ application control system. See Field-IQ operation (page 347).
	FieldLevel II. See Leveling (page 396).
	FieldLevel II, tandem. See Tandem scraper controls (page 409) and Tandem / dual scraper setup (page 275).
	GreenSeeker. See GreenSeeker functionality (page 216).

Button	Opens the feature panel for...
	Guidance mapping. See Guidance pattern use (page 323) and Field feature use (page 322).
	ISOBUS Task Controller. See Task Controller operation (page 373).
	ISOBUS Virtual Terminal. See Virtual Terminal operation (page 374).
	Manual guidance. See Manual guidance operation (page 358).
	Remote Output. See Remote Output setup (page 118).
	Row Guidance. See Row Guidance operation (page 379).
	Serial Rate Control. See Variable rate controller setup (page 229).
	Survey. See Create a survey (page 392).
	TrueGuide system. See TrueGuide operation (page 386).
	TrueTracker system. See TrueTracker operation (page 383).
	Vehicle Sync. See Vehicle Sync (page 260).
	WM-Drain. See WM-Drain operation (page 410).
	Yield Monitoring. See Yield Monitoring operation (page 428).

Engage button

WARNING – Many large and sudden changes in satellite geometry caused by blocked satellites can cause significant position shifts. If operating under these conditions, auto-guidance systems can react abruptly. To avoid possible personal injury or damage to property under these conditions, disable the auto-guidance system and take manual control of the vehicle until conditions have cleared.

The **Engage** button displays on the *Run* screen when you are using an automatic steering system such as:

- Autopilot system operation (page 359)
- EZ-Pilot system operation (page 362)
- EZ-Steer system operation (page 365)

Indicator/Button	Explanation	Tap to...
Ready to Engage (yellow)	The vehicle is close enough to the guidance line to engage on it.	Engage on the guidance line.
Engaged (green)	The vehicle is engaged on the guidance line.	Stop engaging on the guidance line.
Not Ready to Engage (red)	The vehicle is not ready to engage on the line because the guidance line is too far from the vehicle.	N/A. You cannot tap this button. It is an indicator only.
Auto steering not allowed (red)	Automatic steering is not allowed due to how it has been set up.	N/A. You cannot tap this button. It is an indicator only.

Coverage button for logging

When you are applying material, the coverage button displays on the *Run* screen. The coverage button controls whether or not you are logging the coverage you are applying.

Indicator/Button	Explanation
Logging Off	Indicates coverage logging is off. Tap to start logging.
Logging On	Indicates coverage logging is on. Tap to stop logging.

See Coverage logging (page 343).

GNSS status

CAUTION – The GNSS antenna may experience interference if you operate the vehicle within 100 m (300 ft) of any power line, radar dish, or cell phone tower.

Tap to see status information on GNSS.

If the feature/plugin you are using has a second GNSS receiver, there will be a satellite icon for both receivers. Tap the other to see status on the second GNSS receiver.

On-screen lightbar for vehicle

The on-screen lightbar indicates where the vehicle is in relation to the guidance line.

- Green indicator lights in center:

- Red LEDs to the left or right: The vehicle has moved off the guidance line

On-screen lightbar for implement

There can be more than one row of lights, depending on the feature/plugin that is being used. The second row shows where the implement is in relation to the guidance line.

See Implement on-screen lightbar (page 384).

Fields

The FM-1000 integrated display Data Dictionary organizes all work preformed based on a Client / Farm / Field / Event structure..

Field creation / selection

1. To change the vehicle or implement, tap **Switch** next to the item and select the one you want.
2. Tap **OK**. The *Field Selection* screen displays.
   - For existing client, farm, field or events, select the appropriate choice from each list.
   - To create new items, tap **New**.

Item	Explanation
Client	Select the client. The Farm list will show only farms associated with this client.
Farm	Select the farm. The Field list will show only fields associated with this farm.
Field	Tap **New**. Enter the new field name.
Event	Select the event.
Event Attributes	Tap to add more information for record keeping.
Variety Setup	Tap to add and edit information on the variety of products that can be distributed from the implement, tap **Hybrid Setup**.

3. Tap **OK** to enter the *Run* screen.

After you create the field, select a swath pattern to use while you drive the field. See Field creation / selection (page 319).

Event Attributes screen

Category	Explanation
Operator Name	Name of the vehicle's operator
Operator EPA#	Vehicle operator's EPA license number. For spreading restricted-use or state-restricted pesticides or herbicides.
Harvest Year	Year the crop will be harvested

Category	Explanation
Farm Location	Country or region where the farm is located
Vehicle	Vehicle used in the operation
Implement	Implement connected to the vehicle
Application method	Method used, such as spraying, seeding, harvesting and so on
Wind speed	Average wind speed
Wind gust speed	Maximum speed of any wind gusts
Wind direction	Average wind direction
Sky conditions	Amount of cloud cover
Soil conditions	Description of the soil's state
Soil type	Description of the soil type
Temperature	Current temperature
Relative humidity	Percentage of humidity
Crop	Crop in the field
Target pests	Pests to be eliminated by spraying
Custom 1	Additional information you enter
Custom 2	Additional information you enter
Custom 3	Additional information you enter
Custom 4	Additional information you enter
Material	Material being applied

Implement selection

1. At the *Home* screen, tap . The *Configuration Selection* screen displays.
2. Next to the existing implement, tap **Switch** to select to a different implement.

Vehicle selection

1. At the *Home* screen, tap . The *Configuration Selection* screen displays.
2. To change the vehicle currently selected, tap **Switch** to select to a different vehicle.

Event summary adjustment

When a field is closed, the system saves an HTML summary for the event.

To reduce the time it takes to close a field, you can prevent the system from saving a summary:

1. At the *Configuration* screen, select System and then tap **Setup**.
2. At the *Display Setup* screen, select Map Settings and then tap **Setup**.
3. At the *Mapping* screen, select Off from the Save Summaries list.

Close a field

After you finish using a field, tap to close it. The system displays a message asking what you want to do next. These options are:

Tap...	To...
Cancel	Return to the currently open field.
Close	Close the current field and return to the *Home* screen.
Open Another	Close the current field, and open a new field.

Field feature use

You can place field features in the field while driving to define on the field points of interest or areas to avoid. There are three types of field feature:

- Point: A single point in the field, such as a tree
- Line: A straight or curved line in a field, such as a fence
- Area: An area of land, such as a pond

Field feature buttons display on the Guidance Mapping panel at the *Run* screen.

Add field features

To add a feature to the on-screen map of your field:

1. At the *Run* screen, tap

to open the Mapping Guidance panel, which contains the buttons for field features you defined.
2. Begin to drive the field.
3. When you reach the point in your field where you want to add a feature, tap the appropriate feature button. If the feature is a line or area feature, the feature will begin. To mark the end of the line or feature, tap the feature button again.

   Note *– You can add a point feature while adding a line or area feature. For example, use a line feature to draw an overhead telephone wire and at the same time use a point feature to add the telephone poles.*

To set up feature buttons, see Field feature mapping settings (page 51).

Guidance pattern use

Guidance patterns enable you to either:

- Manually steer on the guidance lines of the pattern using the on-screen lightbar to guide your accuracy
- Use an automatic steering system to engage on and drive on the guidance lines of the pattern

The swath measurement is based on the implement width you are using.

Creating patterns

The guidance pattern types available in the display to create are:

- Straight swaths created using an AB line or an A+ line (see Straight guidance pattern (page 327))
- Curved pattern (page 329)
- Circular pivots. See Pivot pattern (page 332).
- Headlands. See Headland pattern (page 330).
- Free form patterns. See FreeForm pattern (page 334).

Access paths

With some guidance patterns, you can add an access path that provides a space such as for a road. See Access paths (page 336).

Existing patterns

After you have created a guidance pattern, you can choose it from the list and:

- Load it for use. See Load a pattern (page 338).
- Shift it. See Shift a swath (page 340).
- Rename it. See Rename a swath (page 339).
- Delete it. See Delete a swath (page 340).

Guidance mapping controls

When you tap

at the *Run* screen, the Mapping Guidance panel displays with controls for features and guidance. The following controls may display in the Mapping Guidance panel, depending on the function you are performing.

Button	Tap to...
Done	Finish an A+ or an AB line.
Feature buttons	Create features in the field, such as boundary, rock, fence and so on. See Field feature use (page 322).
Next	Load the next master line in the Swaths library with each tap. ***Note*** *– The active master line name will be displayed on the Run screen.*
	Project a straight line in front of the on-screen vehicle.
Pause	Pause recording a path.
Resume	Stop pausing and resume recording the path.
Record	Record the path you are driving.
Stop Recording	Stop recording the path you are driving.
Set A	Set the A point of an AB line.
Set B	Set the B point of an AB line.
Skip	Skip a swath (page 342).
Swaths	Open the Swaths Management screen.
Use A+	Set the point of an A+ line.

Swaths Management screen

From the Mapping Guidance panel, you can access the *Swaths Management* screen by tapping . The tabs on this screen are:

Tab	On this tab, you can:	See...
Swaths	Choose the type of pattern you want to create	Straight guidance pattern (page 327) Curved pattern (page 329) Headland pattern (page 330) Pivot pattern (page 332)
	Shift, rename or export an existing pattern	Rename a swath (page 339) Shift a swath (page 340)
	Import or delete an existing pattern	Import AB Lines or boundaries (page 337) Delete a swath (page 340)
	Add an access path	Access paths (page 336)
Line Features	A list of line features you have created and can load.	Field feature use (page 322)
FreeForm	Set when the path is recorded and whether you want the U-turn at the end of a path to be recorded. Delete all line segments created in your FreeForm pattern.	FreeForm pattern (page 334)
Features	A list of features you have created in the field.	Field feature use (page 322)

The buttons on the bottom of the *Swaths Management* screen are:

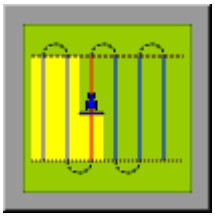
Buttons	Tap to...	See...
No AB	Prevents the AB guidance lines from being loaded (for WM Form activities).	
New FreeForm	Begin a new FreeForm line and go to the *Run* screen.	FreeForm pattern (page 334)
Load	Load a new pattern.	Load a pattern (page 338)
Close	Close the *Swaths Management* screen and	

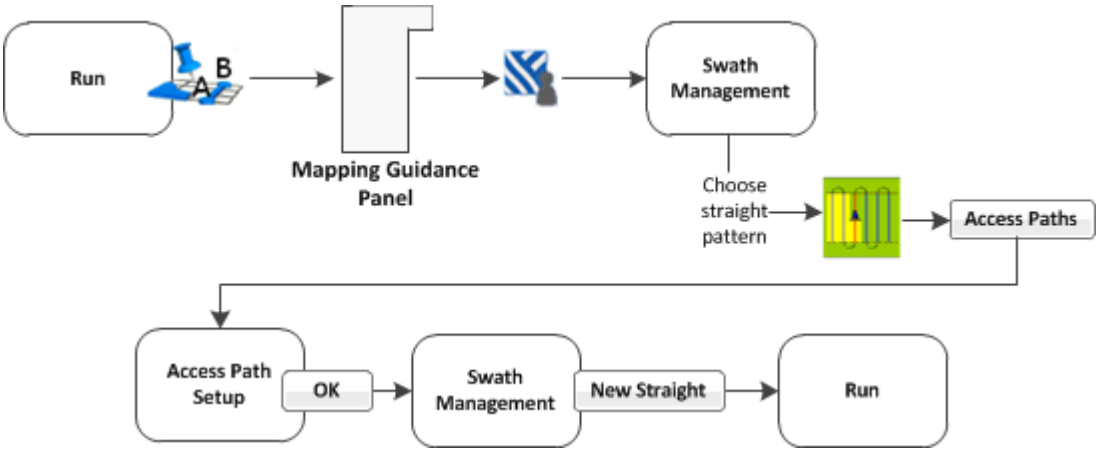
Buttons	Tap to...	See...
	return to the *Run* screen.	
New Straight	Begin a new straight line and go to the *Run* screen.	Straight guidance pattern (page 327)
Import	Open the *Import Swaths* screen to import AB lines or boundaries.	Import AB Lines or boundaries (page 337)

Straight guidance pattern

There are two ways to create a straight guidance pattern:

- Create an AB Line: Define the start and end points.
- Create an A+ Line: Define a point on the line and the heading direction.





AB line creation

To create a straight AB line:

1. At the *Run* screen, tap to open the Mapping Guidance panel.
2. Tap **Swaths**.
3. At the *Swath Management* screen, select the AB pattern from the pattern list.
4. Enter an access path, if required. See Access paths (page 336).
5. Tap **New Straight**. The *Run* screen displays.
6. To create the start point of the line, tap **Set A**.
7. Drive to the end of the line.

   Note *– The end (B) point must be at least 50 meters (160 feet) from the A point.*

8. Tap **Set B**. The new AB line displays.
9. To extend the line, drive further along it and then tap **Set B** again.
10. Tap **Done** to indicate you have finished.
11. The system automatically creates the remaining swaths. If you need to shift or skip a swath, see:
    - Shift a swath (page 340)
    - Skip a swath (page 342)

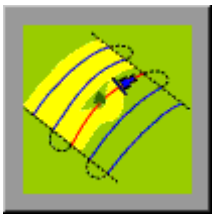
A+ line creation

To create a straight A+ line:

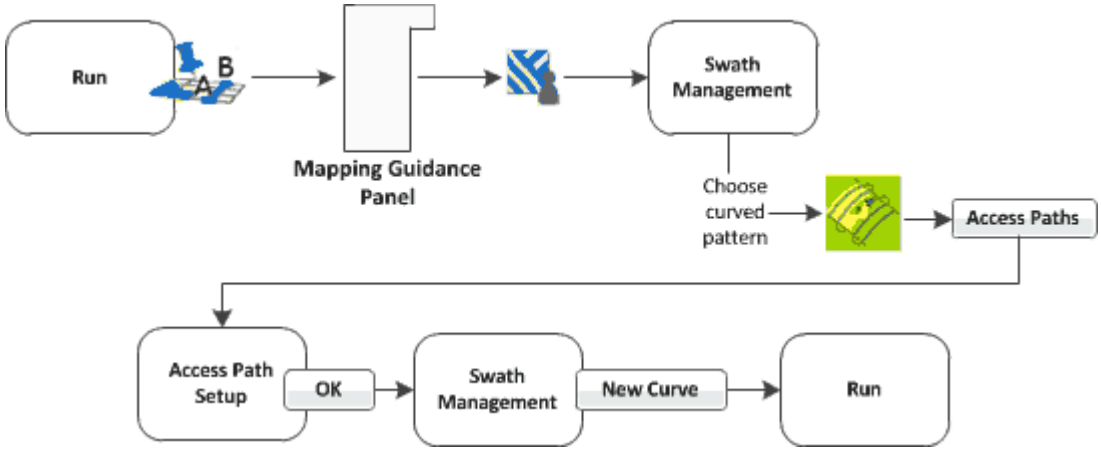
1. At the *Swath Management* screen, select the A+ pattern from the pattern list.
2. Enter an access path, if required. See Access paths (page 336).
3. In the A+ Heading entry box, enter the angle that you want the line to be on or select a previous AB Line to use its heading.

   Note *– The default angle is the same as the previous AB Line heading.*
4. Tap **New Straight**. The *Run* screen displays.
5. Drive to the start of the line and then tap **Set A**.
6. Tap **Use A+**. The new A+ line displays.
7. Tap **Done**.
8. The system automatically creates the remaining swaths. If you need to shift or skip a swath, see:
    - Shift a swath (page 340)
    - Skip a swath (page 342)

Curved pattern



1. At the *Run* screen, tap to open the Mapping Guidance panel.
2. Tap **Swaths**.
3. At the *Swath Management* screen, select the Curve pattern from the pattern list.
4. Enter an access path, if required. See Access paths (page 336).
5. Tap **New Curve**. The *Run* screen displays.



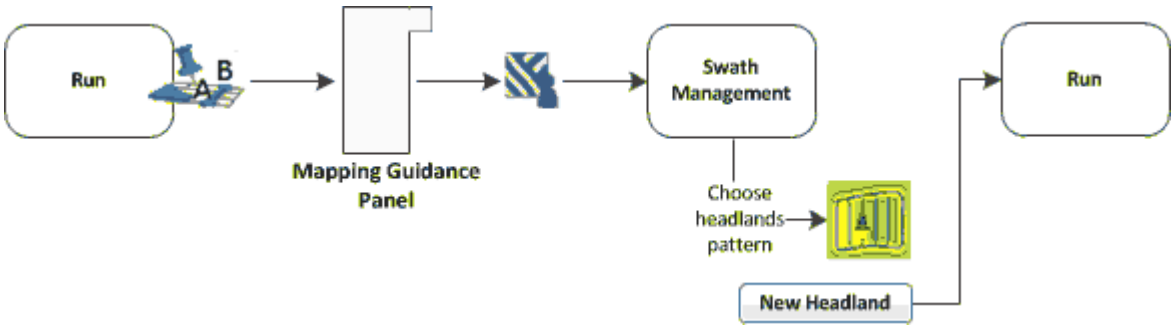
6. Drive to the start point of the curve and then tap **Set A**.
7. To stop recording your exact path and create a straight section of line, tap **Record**.
8. Drive the curve until you reach the end point and then tap **Set B**. The new curve pattern displays showing all the swaths the system automatically generated.
9. If you need to shift or skip a swath, see:
   - Shift a swath (page 340)
   - Skip a swath (page 342)

Headland pattern

A headland is a straight AB Line or an A+ line pattern that is confined inside a boundary. This boundary is called the headland.

Note *– If you want to create a headland based on the A+ line pattern, select the straight line pattern and then set the A+ heading for the internal line. Then complete the following steps.*

1. At the *Run* screen, tap to open the Mapping Guidance panel.
2. Tap **Swaths**.
3. At the *Swath Management* screen, select the Headlands pattern from the pattern list.In the # Headlands entry box, enter the width of the headland boundary in swaths. For example, if you enter 2, the headland will be two swaths wide.
4. Tap **New Headland**. The *Run* screen displays.



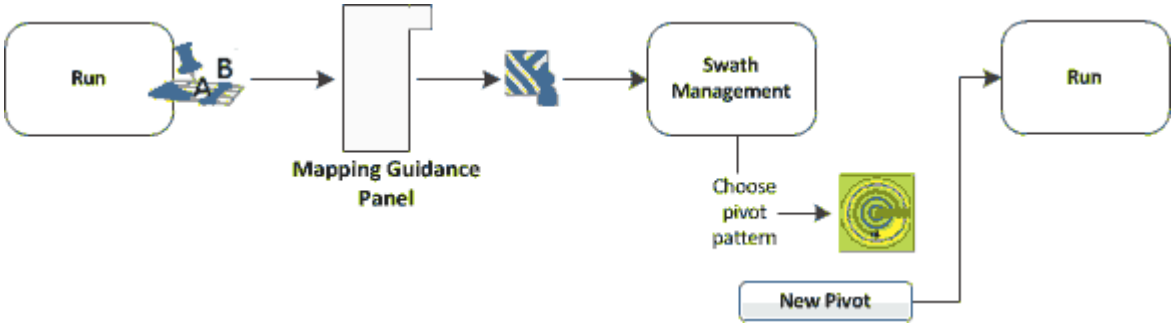
5. Drive to the start point of the headland and then tap . A red line displays behind the vehicle to show that the headland is being recorded.
6. Define the inner pattern before you complete the headland. To do so, tap **Infill**. The Mapping Guidance panel changes to show the inner pattern buttons.

   Note *– After infill lines have been created, they cannot be moved.*
7. When you reach the location for the A point, tap **Set A**.
8. To create an internal AB Line, drive to the location for the B point (at least 50 m (164 ft)) and then tap **Set B**.
9. To create an internal A+ line, tap **Use A+**.

10. Tap **Back to HL**. The Mapping Guidance panel returns to its original appearance.
11. When you complete the headland circuit, the system will draw a straight line from the vehicle back to the start point. Drive the vehicle to a position on the headland circuit where a straight line back to the start will not cut off part of the pattern.
12. Tap **Close HL**. The new headland displays showing all the swaths that the system has automatically generated.
13. If you need to shift or skip a swath, see:
    - Shift a swath (page 340)
    - Skip a swath (page 342)

Pivot pattern

1. At the *Run* screen, tap to open the Mapping Guidance panel.
2. Tap **Swaths**.
3. At the *Swath Management* screen, select the Pivot pattern from the pattern list.
4. Tap **New Pivot**.
5. The *Run* screen displays.



6. Drive to a point on the outermost rut of the pivot and then tap **Set A**.
7. Follow the pivot rut around to the end and then tap **Set B**. The *Enter Distance to Pivot Field Edge* screen displays.
8. Enter the distance or the number of rows from the current path to the outside of the pivot and then tap **OK**. The pivot displays, showing the swaths it generated.
9. If you need to shift or skip a swath, see:
   - Shift a swath (page 340)
   - Skip a swath (page 342)

Outer edge radius adjustment

The pivot has an outer edge radius that is used to calculate the coverage area. After you create a pivot, you can adjust this outer edge radius.

1. At the *Run* screen, tap **Swaths**. The *Swath Management* screen displays.
2. Select the pivot to be adjusted from the list of available pivots.

   Note – *The default is the AB curve.*
3. In the Outer Edge Radius entry box, adjust or enter the value that represents the distance from the pivot center to the outer edge and tap **OK**. The *Swath Management* screen displays.
4. To update the pivot, tap **Load**. The *Run* screen displays with the new pivot dimensions.

FreeForm pattern

Using the FreeForm pattern, you can create non-symmetrical guidance paths in fields that have irregular shapes. FreeForm combines these patterns:

- Straight line guidance segments
- Curved guidance segments

With this combination, you can use the FreeForm pattern to create circular spirals or guidance lines with curved and straight line segments for irregular-shaped fields as well as rugged topographics.

Unlike the other patterns where the next swath is repeated, you must drive and record all paths.

Create a FreeForm pattern

1. At the *Run* screen, tap

to open the Mapping Guidance panel.
2. Tap **Swaths**. The *Swath Management* screen displays.
3. Select the FreeForm tab and complete the settings.

Setting	Explanation
Record Swath	• Manually: Use the record button to record the path. • When Logging: Record the path when you are logging coverage. ***Note*** *– If you have an external remote logging switch that controls coverage logging, the system records FreeForm curves when the remote logging switch is enabled).*
U-Turn Detection	• Auto: Do not record the U-turn at the end of a path. • None: Do record the U-turn at the end of a path.
Delete All	Removes all segments of the FreeForm pattern you have recorded.

4. Tap **New FreeForm**.
5. To begin recording, you can either:
   - Tap .
   - Tap (if you have set up to record logging coverage while you are engaged. See Engage settings for Autopilot system (page 148), Engage settings for EZ-Pilot system (page 168) or Engage settings for EZ-Steer (page 173) and Coverage logging (page 343).
6. To stop recording, you can:

- Tap if you are recording manually.
- Tap to stop logging coverage (if you have set up to record logging while you are engaged. See Engage settings for Autopilot system (page 148), Engage settings for EZ-Pilot system (page 168) or Engage settings for EZ-Steer (page 173) and Coverage logging (page 343).

7. To create a straight line within a FreeForm path:
   a. Make sure you are actively recording and the vehicle is moving forward.
   b. Tap . The system projects a straight dashed line from the front of the on-screen vehicle based on the current heading.

   You can immediately engage on this line and the path driven is recorded.
   c. To stop recording the path, disengage automatic steering by either tapping to disengage the automatic steering or moving the steering wheel more than 5 degrees.

Pause recording

You can pause recording and then begin recording again. This is useful when you encounter areas or objects you are driving around but will not need to drive around on the next line.

1. Tap .
   - A pause indicator displays on map.
   - A straight dashed line projects from the rear of the moving vehicle based on the current heading.

   - The pause button changes to .

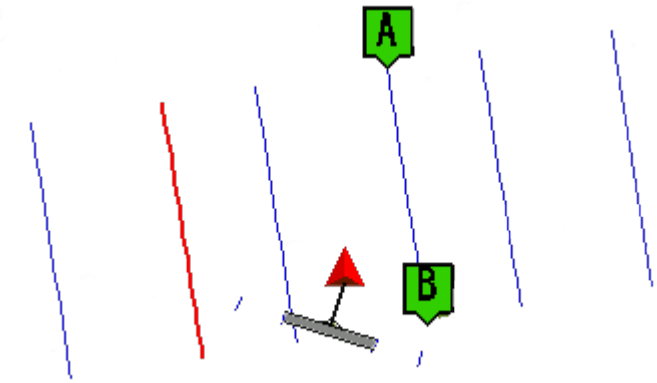
- Your position is saved to a file on the display. You can then close the field and power off the display. When you open the field again, you will be guided back to your former position.

2. When you have returned to your desired position (for example, after driving around an obstacle), tap to stop the pause and snap a straight line from the initial pause location and the current vehicle position.

Access paths

An access path is a space between your guidance lines. These paths can be useful if there is road (or other field feature that breaks the consistent flow of swaths) through the middle of your field.

Note *– You can add access paths on a straight or curved pattern, but not headlands or pivots.*



1. At the *Run* screen, tap to open the Mapping Guidance panel.
2. Tap **Swaths**.
3. At the *Swath Management* screen, tap **Access Paths**. The *Access Path Setup* screen displays. Complete the settings on this screen and tap **OK**.

Setting	Explanation
Swaths between access paths	This value must be equal to or higher than the Swaths in first group setting. The next access path will display this number of swaths beyond the first access path, and will continue to repeat after this number of swaths. The access path will display after this number of swaths (including the master line).
Path width	Width of the access path
Swaths in first group	Enter the number of swaths
ABs place in the first group (left to right)	Enter a value in the ABs place in the first group (left to right) entry box. This setting enables you to specify where the master line displays in the first group (from left to right).
Provide Guidance to	Select whether guidance will be based on swaths or access paths.

Switch to the next pattern

You can switch from one existing line pattern to another. To do so, tap .

Each time you tap , the system changes the line pattern to the next pattern available in the list on the *Swaths Management* screen (Swaths tab).

The system switches to the next available pattern and displays the name of the active pattern on the Mapping Guidance panel.

Note *– FreeForm cannot be actively recording the path for the Next button to be active.*

Import AB Lines or boundaries

The FM-1000 integrated display can load field boundaries and AB Lines created by:

- A Remote Data Logger (RDL)
- A Geographic Information System (GIS)

Note *– To load GIS boundaries, files must be in WGS-84 latitudes, longitudes, and heights in decimal degrees.*

To import an AB Line or a boundary into the display:

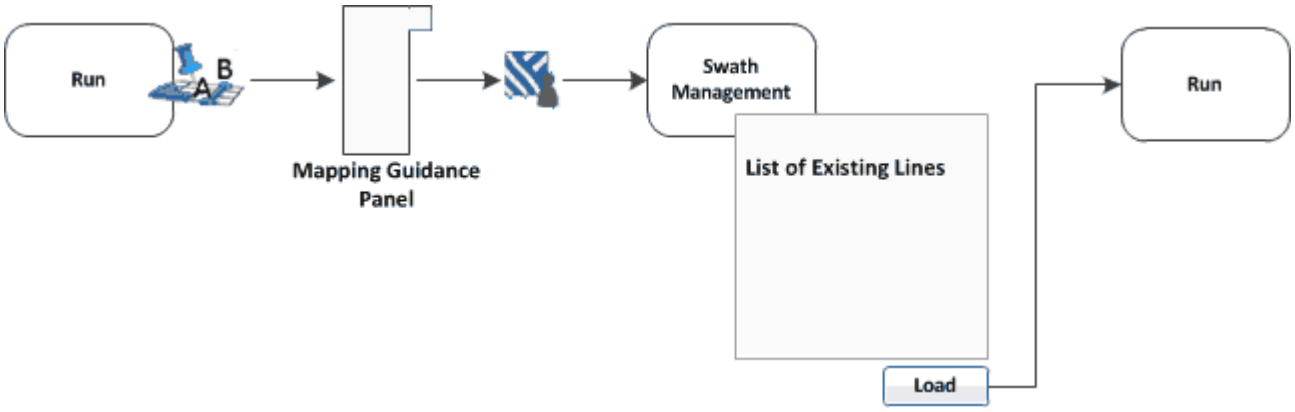
1. Insert the USB drive into an office computer.

The three files that define a line or field (.shp, .shx, and .dbf) must have identical names. Otherwise, they are not recognized. If you put multiple sets of files in the folder, ensure that you do not have more than one set of files with each name or your files will be overwritten.

2. Copy the following files to the \AgGPS\AB Lines\ folder on the USB drive:
   - <field name>.shp
   - <field name>.shx
   - <field name>.dbf
3. Power on the display, then tap .
4. Either open an existing field or start a new field.
5. Tap **Swaths**.
6. Tap **Import**. The *Import Swaths* screen displays.
7. Tap the field or AB Line to import from the list of available swaths and then tap **OK**. The field or AB Line is imported.

   If the AB Line file contains more than one AB Line, all AB Lines in the file are imported.
8. Tap the AB Line that you want to use and tap **Load**. A warning message displays.
9. Tap **OK**. The imported field or AB Line is ready to use.
10. For best results, close the field and then reopen it.

Load a pattern



To load a line/pattern you previously created in a field:

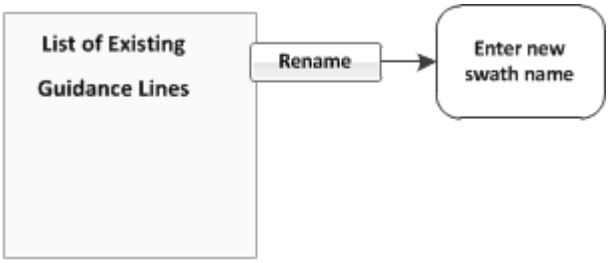
1. At the *Run* screen, tap to open the Mapping Guidance panel.
2. Tap **Swaths**. The *Swath Management* screen displays.
3. To load a pattern, select it from the list on the left of the screen. The system loads the closest pattern to you.
4. Tap **Load**. The *Run* screen displays, with the pattern loaded.

   If you try to load a pattern that is over 100 km (63 miles) away, the following message displays:

   Your current position is too far from the field to work in it.

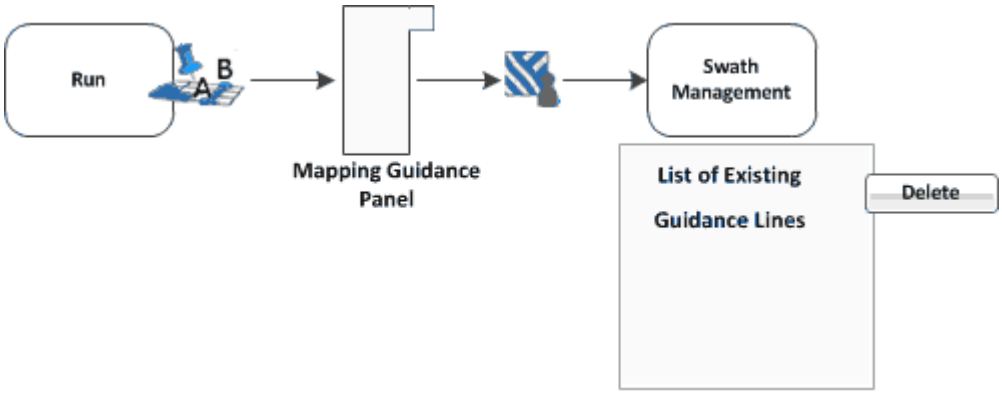
Rename a swath

Note *– To rename swaths, you must have entered the administration password. You cannot rename line features or FreeForm curves.*



1. At the *Run* screen, tap to open the Mapping Guidance panel.
2. Tap **Swaths**. The *Swath Management* screen displays.
3. From the list on the left, select the swath to rename.
4. Tap **Rename**. If prompted, enter the password. The *Enter new swath name* screen displays.
5. Enter the new name for the swath and tap **OK**. The *Swath Management* screen displays again.
6. To return to the *Run* screen, tap **Close**.

Delete a swath



Note *– To be able to delete swaths, you must have entered the Administration password.*

1. At the *Run* screen, tap to open the Mapping Guidance panel.
2. Tap **Swaths**. The *Swath Management* screen displays.
3. From the list on the left, select the swath to delete.
4. Tap **Delete**. If prompted, enter the password. The swath is marked as deleted. The next time you close the current field, the swath does not show in the list.

   Note *– You cannot delete a swath that is currently active.*
5. To return to the *Run* screen, tap **Close**.

Switch to the next pattern

You can switch from one existing line pattern to another. To do so, tap .

Each time you tap , the system changes the line pattern to the next pattern available in the list on the *Swaths Management* screen (Swaths tab).

The system switches to the next available pattern and displays the name of the active pattern on the Mapping Guidance panel.

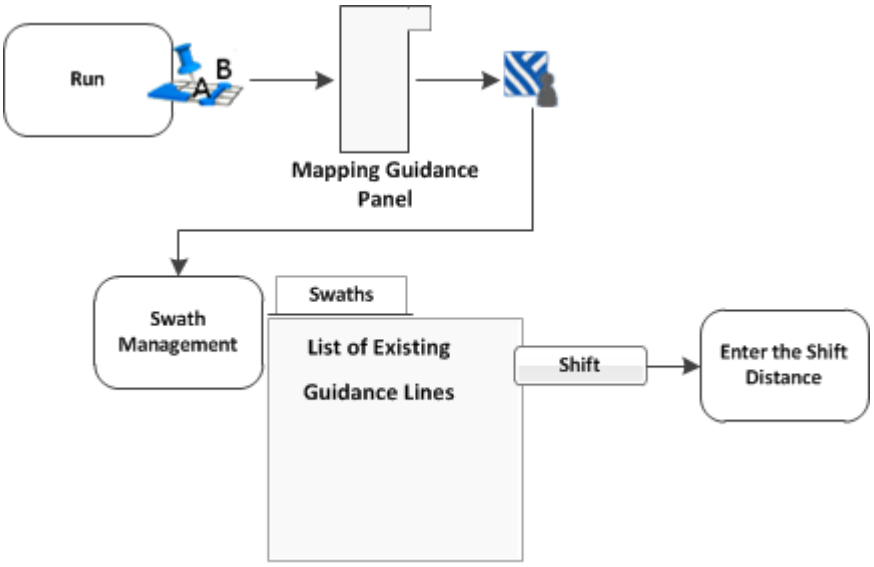
Note *– FreeForm cannot be actively recording the path for the Next button to be active.*

Shift a swath

Note *– Shifting a swath is a permanent adjustment. To temporarily change the spacing of swaths, skip a swath instead. See* *Skip a swath (page 342)**.*

Note *– You cannot shift line features or FreeForm curves.*

1. At the *Run* screen, tap to open the Mapping Guidance panel.
2. Tap **Swaths**. The *Swath Management* screen displays.
3. Select the swath to shift from the list on the left.
4. Tap **Shift**. The *Enter the Shift Distance* screen displays.



5. Enter the values.

Setting	Tap to...
Left	Shift the line to the left of your view.
Right	Shift the line to the right of your view.
Value entry boxes	Enter the distance you want to shift the line.
Metric	Change to metric values.
Feet & Inches	Change to feet and inches.
Decimal Feet	Change to decimal feet.
Rows	
Calculator	Open the calculator.

Note *– If you shift a line, it will shift the original version of the line and remove any skip that you have applied.*

6. Tap **OK**. The *Swath Management* screen displays. The newly shifted swath displays in the swath list on the left of the screen.

Skip a swath

Note *– The Skip position of a swath line is temporary and is not saved permanently. To save such an adjustment, shift the swath instead. See* *Shift a swath (page 340)**.*

FM-1000 integrated display uses the original swath that you drove to automatically generate the position of the other swaths. Occasionally, the on-screen swaths do not accurately indicate where your swaths are. For example, you may need to skip a swath to drive to the other side of a road.

To temporarily correct the spacing of the automatically generated swaths in a field:

1. At the *Run* screen, tap

to open the Mapping Guidance panel.
2. Tap **Skip**. The *Enter the Skip Distance* screen displays.
3. Complete the settings.

Setting	Tap to...
Left	Shift the line to the left of your view.
Right	Shift the line to the right of your view.
Value entry boxes	Enter the distance you want to skip to the next swath.
Metric	Change to metric values.
Feet & Inches	Change to feet and inches.
Decimal Feet	Change to decimal feet.
Rows	
Calculator	Open the calculator.

   The swath line moves the required amount.
4. Tap **OK**. The *Swath Management* screen displays. The newly shifted swath displays in the swath list on the left of the screen.

   Note *– The skip occurs based on the direction of the vehicle, not on the A-to-B orientation of the line. For example, if you select Left, the line shifts to the left of your view.*

Coverage logging

When you are applying material, the coverage button displays on the *Run* screen. The coverage button controls whether or not you are logging the coverage you are applying.

Indicator/Button	Explanation
Logging Off	Indicates coverage logging is off. Tap to start logging.
Logging On	Indicates coverage logging is on. Tap to stop logging.

When the system logs coverage, it records the area that you have covered when you carry out an operation (such as applying fertilizer to a field).

If you have chosen to log coverage, the covered area displays on the *Run* screen as a pale yellow area that shows:

- Coverage the first time
- Any skips in coverage
- Areas you covered twice or three times

Coverage logs record more than the applied material. See View coverage layers (page 343) and Log coverage for varieties (page 344).

You can begin logging coverage:

- Manually by tapping
- Automatically if you are using automatic steering and tapping .See Engage settings for Autopilot system (page 148), Engage settings for EZ-Pilot system (page 168), or Engage settings for EZ-Steer (page 173).

If you are applying a variety of materials, you can set up coverage to show the varieties. See Log coverage for varieties (page 344).

View coverage layers

1. To see different aspects (or layers) of coverage on the screen, tap on the lower left side of the screen.
2. Select the layer you want to view.

Layer	Explanation
Overlap	General coverage and overlap
Height	Altitude of GPS receiver
GPS Quality	Quality of GPS signal
Cut/Fill	Cut or fill (for water management operations)
Variety	Different varieties being applied
Applied Rate	Rate at which material is being applied
Speed	Speed of the vehicle
Average Cross Track Error (XTE)	Position of the vehicle in relation to the guidance line

Log coverage for varieties

By default, coverage is displayed on the screen as a pale yellow. However, if you are applying varieties, you can set up the system to make different varieties visible on the screen.

By logging varieties, you can:

- Change product in a field, so that you can later identify which parts of the field are covered in which product.
- Plant or apply two or more different products side by side and record the locations in your field. For example, track the planting of:
  - Corn seed in the left side hoppers
  - Clover seed in the right side hoppers

Varieties are assigned to rows on your implement. Specify the number of rows on your implement when you configure it. For more information, see Edit implement settings (page 140).

Set up variety logging

To log varieties:

1. At the *Home* screen, tap . The *Field Selection* screen displays.
2. Tap **Hybrid Setup**. The *Hybrid Setup* screen displays. Use this screen to complete the settings for hybrids.

Setting or Button	Explanation
Left-hand list	List of varieties.
Add	Add a new variety and select a name for it.
Remove	Select a variety name in the left-hand list and tap **Remove** to delete it.
Edit	Select a variety name in the list and tap **Edit** to change the settings. The *Variety Attributes* screen displays. Enter a name for the variety, choose the color to display for the variety and optionally complete additional record keeping information.
Assign	Select the variety from the left-hand list and tap **Assign**. For each variety, select the row numbers on your implement that will be applying the variety.

Setting or Button	Explanation
Clear	Tap to clear all current entries.

3. When you have finished with the settings, tap **OK**.

When you enable coverage logging and set the Mapping Guidance panel list to Variety, this variety color displays in the guidance window.

> **Tip –** For quick access to the *Hybrid Setup* screen from the Run screen, set the Mapping Guidance panel list to Variety and then tap **Attributes**.

If you select a different implement or change the settings of the current implement, the variety assignments are removed.

Field-IQ operation

WARNING – When the implement is down and the master switch is in the On position, the machine is fully operational. Take all necessary precautions to ensure user safety. Failure to do so could result in injury or death.

1. At the *Home* screen, tap .
2. At the *Current Configurations* screen, configure the display/vehicle/ implement settings and then tap **OK**.
3. At the *Field Selection* screen, select the required client/farm/field/event settings and then tap **OK**.

For setup information, see Field-IQ system setup (page 184).

Field-IQ panel

To open the Field-IQ panel, tap . The panel displays. Within the panel, you can navigate to many views:

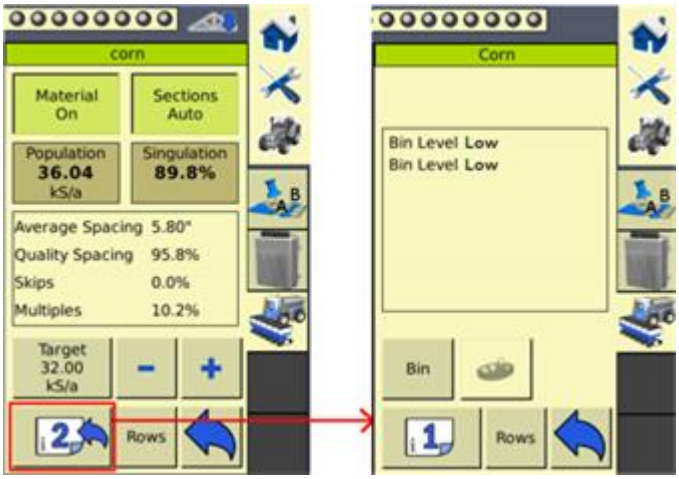
- Material detail view (page 348)
- Row detail view (page 350)
- Section control view (page 351)

Material detail view

The main view shows a list of materials. Up to six materials are listed. The current target and actual rates are shown for each material.

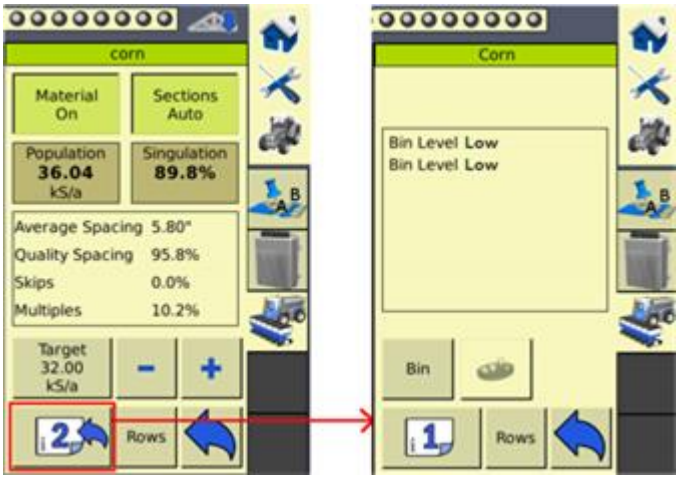
Material details, page 1

Tap the material to see the first details view of the material.



Page 1 Buttons	Tap to...
Material On	Turn the material on or off.
Sections Auto	Turn automatic section control on or off.
Target	Select if Target 1 or Target 2 is shown, or to select Manual to turn the Target rate off. Tap − to decrease the Target rate by 1. Tap + to increase the Target rate by 1.
	To see the second detailed view of the material.
Rows	To go to the Row detail view (page 350).

Material details, page 2

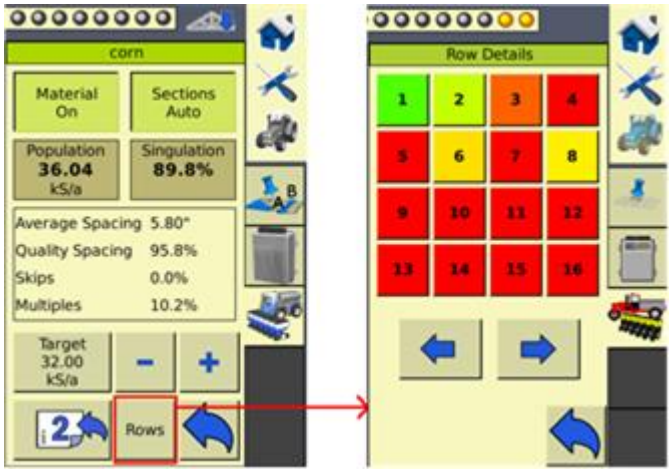


Depending on the material, the following buttons display on the second page of the material details view.

Page 2 Buttons	Tap to...
Bin	Go to the *Virtual Bin / Tank Setup* screen where you can adjust the bin settings.
Seed Disc	Fill the seed disk.
Arm Pump	Enable Field-IQ to control the pump.
Gate Setup	Go to the *Gate Setup* screen.
Density	Go to the *Density* screen where you can enter the density of the current product.
	Return to the previous detailed view.
Rows	To go to the Row detail view (page 350).

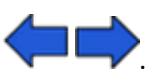
Row detail view

To see detailed information on the rows, tap **Rows**.



The color of the row numbers indicate how far off target the rows are applying.

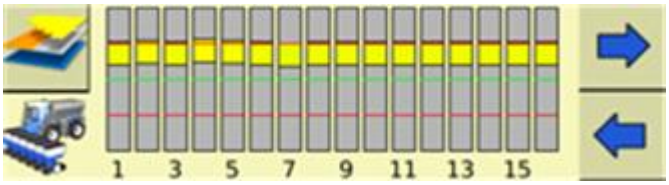
- Green: Rows are applying on target.
- Red: Rows are applying off target.
- Black: Rows have been manually turned off.
- White: Rows have been turned off automatically by the system.

To view more rows, tap the arrow buttons  .

To return to the previous view, tap .

Section control view

To open the section control view on the *Run* screen, tap in the lower left corner of the screen.



The section control view shows the engage status of each row on the implement:

- Green: Engaged
- Gray: Section closed due to overlap
- Red: Not engaged or section manually turned off

Field-IQ master switch box functions

Note *– All systems must have a Field-IQ master switch box.*

Item	Setting	Explanation
1	Increment/ decrement switch	Increases or decreases the applied amount by a set amount (the amount is set in the *Setup* screen, Rate tab).
2	Rate switch	Preset Rate 1, preset Rate 2, or Manual rate.
3	LED indicator	• Red: Unit is powered but not communicating with the FM-1000 integrated display. • Green: Unit is powered and communicating with the FM-1000 integrated display. • Yellow: Unit is initializing communications with the FM-1000 integrated display.

Item	Setting	Explanation
4	Automatic/Manual section switch	You can switch from Automatic to Manual mode while traveling. • Automatic mode: The FM-1000 integrated display automatically opens and closes sections when entering areas of overlap, non-apply zones, or crossing boundaries. • Manual mode: The sections are controlled by the user using the Field-IQ system.
5	Master switch	• 5a: Jump start position. The same functions as in Master On are active, plus the system is overridden to use a preset control speed (the speed is set in the *Setup* screen, Override tab). • 5b: On position. The sections and rate are ready to be commanded by the FM-1000 integrated display. • 5c: Off position. Sections are closed and rate is set to zero. When you use Lock in Last Position, the valve is locked and the rate is controlled by an auxiliary master valve or section.

Field-IQ 12-section switch box (optional)

Only one section switch box can be used on each system. Each section switch is automatically assigned to the corresponding section. The sections are read from left to right. For example, switch 1 assigns to the section furthest on the left when standing behind the implement. For more information, see the Hardware tab in *Setup* screen of Field-IQ.

The section switches have different functions, depending upon the status of the master Automatic/Manual section control switch on the master switch box.

Automatic section control

When the Automatic/Manual section control switch is in the Automatic position, if the section switch is in the:

- On/up position: The section(s) assigned to it are commanded automatically by the FM-1000 integrated display.
- Off/down position: The section(s) assigned to it are commanded to be off.

Manual section control

When the Automatic/Manual section control switch is in the ***Manual*** position, if the section switch is in the:

- On/up position: The section(s) assigned to it are commanded to be on. This overrides the display and coverage logging is ignored.
- Off/down position: The section(s) assigned to it are commanded to be off. This overrides the display and coverage logging is ignored.

LED status indicators

The LED indicators on the section switch box are:

- Green: Unit is powered and is communicating with the display.
- Yellow: Unit is initializing communications with the display.
- Red: Unit is powered but not communicating with the display.

Material assignment

To change materials quickly and easily:

1. At the *Material Assignment* screen, tap the material to change. A list of available materials displays.
2. Select the material you want from the list and tap **OK**.

Material assignment

Use the Material Assignment option to quickly and easily change materials. The location name you set up displays (for example, Hoppers) and the button shows the current material name.

Tap the button to see a list of the same type of materials. To change the material type, select the required material from the list, and then tap **OK**.

Enable sections

To enable sections:

1. At the *Home* screen, tap .
2. At the *Configuration* screen, tap Field-IQ and then tap **Diagnostics**.

3. At the *Field-IQ Diagnostics* screen on the Operations tab, tap the section you want to enable.

Enter values manually

To enter values manually:

1. At the *Home* screen, tap .
2. At the *Configuration* screen, tap Field-IQ and then tap **Diagnostics**.
3. At the *Field-IQ Diagnostics* screen on the Operations tab, you can enter values manually for:

Setting	Explanation
Tank Level	Enter a value or tap **Refill Tank**.
Target Rate	Use the buttons to decrease or increase the required rate for the rate switch.
Speed	Use the buttons to decrease or increase speed.
Aggressiveness	Check the value for Applied Rate. Increase or decrease aggressiveness to achieve the rate you want.

Test optional switch box

To test the optional switch box:

1. At the *Home* screen, tap .
2. At the *Configuration* screen, tap Field-IQ and then tap **Diagnostics**.
3. At the *Field-IQ Diagnostics* screen on the Operations tab:
   a. Flip each switch in the section switch box.
   b. The section it is assigned to displays as gray.

Prescriptions

To send target rates to the variable controller, you can define variable rate controller setup data and load prescription files that define the rates to be applied in different areas of the field. This information is used to send target rates to the variable rate controller. Applied rates are received

from the controller, and both target and applied rates display on the screen. In addition, you can log data relating to the variable rate application to the hard drive.

After you create the prescription, store either the three prescription files in ESRI shape-file format or the single .gdx file in the \AgGPS\Prescriptions\ folder. Then, when you are within the proximity criteria, the prescription is available to load.

If you use complex contoured prescriptions, loading the prescriptions can take some time. The display shows progress bars while it loads and converts prescriptions.

You can configure the status sliders on the main navigation screen (the Run screen) to show the target rate specified in the prescription file, and the applied rates returned from the controller for the active channel.

When a field is open, a prescription is loaded, and a controller is connected, the target rates (read from the prescription) and applied rates (received from the controller) can be shown in the status text items. For more information, see Status items (page 64).

The FM-1000 integrated display can load prescription files created by a Geographic Information System (GIS). The method you use to create the prescription depends on which GIS package you use.

When you map a new field or select an existing field, you can also select any shapefile (.shp) or AgInfo GDX (.gdx) prescription file created in AgInfo version 3.5.44.0 or later, that is within these limits:

For...	Prescriptions must...
Boundary	Overlap the field boundary
AB Line	Overlap the AB Line
Proximity	Be within 1 km of the field

If you load a shapefile prescription, select the rate column.

CAUTION – When you select a shapefile prescription, the applied rate will be incorrect if you choose the wrong column when using a variable rate controller.

Load prescription file

A prescription works only when the Field-IQ rate selection switch is in the Rate 1 position.

Rate Switch Position	Increment/Decrement Switch Status
Rate 1	Disabled
Rate 2	Enabled

To load a prescription file:

1. Map a new field or select an existing field. The FM-1000 integrated display lists the prescription files within the specified limits. If there are many prescriptions on the hard drive, this can take several seconds, and a progress bar displays.

   If any prescription files are within the specified limits, the *Select Prescription* screen displays.

2. From the Available Prescriptions list, select a prescription file.

   Note *– If an AgInfo GDX prescription has an incorrect format, it will not display in the Available Prescriptions list.*

   - If you select a shapefile prescription, select the correct prescription rate column.

     Note *– When you select a shapefile prescription, if you choose the wrong column when using a variable rate controller, the applied rate will be incorrect.*

   - If you select an AgInfo GDX prescription, the Rate Column box does not appear.

3. From the Prescription Scale Factor, select the scale factor for the units used in the prescription file.
4. Set the lead time.
5. From the When off prescription use list, select the target rate for when you are outside the area that is covered by the prescription file. See Prescriptions (page 354).
6. Tap **OK** to load the prescription file.

Lead time

Lead-time is the average time required by the controller before it can react to a requested rate change. Define the lead time in the *Select Prescription* screen. For example, a value of 5.0 means that, on average, it takes the controller around five seconds to change from one rate to a new rate.

The direction and speed of the vehicle are combined with the lead time to project a future position of the vehicle. The target rate at this projected position is sent to the variable rate controller, giving the controller time to reach the required rate at approximately the same time that the vehicle arrives at the projected position.

You must choose an appropriate lead time. This depends on the:

- Controller type and configuration
- Type of materials being applied
- Nature and specifications of the delivery equipment

Control outside the prescription area

When the vehicle moves outside the area covered by the prescription file, no target rate is available. There are three options for controlling the output rate:

- Continue to use the last rate being output when the vehicle moves off the prescription
- Use a default rate
- Use a zero rate

Specify the required option in the *Select Prescription* screen.

You can now select prescriptions even when the vehicle is a great distance away from the field, which enables you to load a prescription before driving to the field.

Manual guidance operation

When you use the Manual Guidance option, you must steer the vehicle manually while you watch the virtual lightbar for guidance.

The ***Run*** screen looks similar to when the Autopilot option is installed, except that:

- There is no Autopilot tab on the right
- There is no **Engage** button

You can still tap to open the Mapping Guidance panel and add field features or create guidance lines.

Autopilot system operation

To engage the Autopilot system, you must have:

- Have a field open in the *Run* screen
- Have an existing pattern you are using
- The vehicle within the distance of the guidance line set in the Engage tab. See Engage settings for Autopilot system (page 148).

When you are using Autopilot, you use the **Engage** button to automatically steer on the guidance line. The Engage button can indicate status and, in some cases, also control the Autopilot system.

Indicator/Button	Explanation	Tap to...
Ready to Engage (yellow)	The vehicle is close enough to the guidance line to engage on it.	Engage on the guidance line.
Engaged (green)	The vehicle is engaged on the guidance line.	Stop engaging on the guidance line.
Not Ready to Engage (red)	The vehicle is not ready to engage on the line because the guidance line is too far from the vehicle.	N/A. You cannot tap this button. It is an indicator only.
Auto steering not allowed (red)	Automatic steering is not allowed due to how it has been set up.	N/A. You cannot tap this button. It is an indicator only.

You can also Adjust Autopilot guidance (page 359) settings during operations in the field.

Adjust Autopilot guidance

At the *Run* screen, tap . The Autopilot panel displays.

Setting	Explanation
Nudge	The guidance line can move off target due to either: • GPS position drift after pausing or turning off the system • GPS satellite constellation changes as you drive in the field Use the < and > buttons to move the line in a perpendicular direction (left or right). To set the increment for this setting, see Steering settings for Autopilot system (page 149).
Trim	Trim replaces Nudge when you are using RTK corrections. The vehicle can steer offline as a result of uneven drag on the vehicle from an unbalanced implement or from soil conditions. Use the < and > buttons to move the vehicle in a perpendicular direction (left or right) of the line you are currently engaged on. To set the increment for this setting, see Steering settings for Autopilot system (page 149).
Online Aggr	Aggressiveness is the measure of how strongly the system makes steering changes. Use the - and + buttons to adjust how aggressively the vehicle moves to the guidance line. A setting that is: • Higher brings the vehicle back online faster, but may cause tight oscillations about the line • Lower: Brings the vehicle back online more slowly, but can avoid overshoot ***Note*** *– The default aggressiveness setting is 100%.*

Disengage Autopilot system

The Autopilot t system can be disengaged automatically and manually.

Automatic disengagement

The Autopilot system disengages automatically when:

- The vehicle is outside the allowed distance from the guidance line set up in the Engage tab. See Engage settings for Autopilot system (page 148).
- The system is paused.
- GPS positions are lost.

Manual disengagement

To manually disengage the system, you can:

- Tap on the screen.
- Turn the steering wheel to override the electric motor.

  When you turn the steering wheel manually, the Autopilot system disengages. It is recommended that you check this setting before you begin using the system in a new installation. To do so:

  a. Engage on a line.

  b. Turn the wheel until Autopilot disengages.

  To make adjustments to the amount of force required to disengage the system using the steering wheel, see Automated Deadzone calibration (page 154).

EZ-Pilot system operation

WARNING – Many large and sudden changes in satellite geometry caused by blocked satellites can cause significant position shifts. If operating under these conditions, auto-guidance systems can react abruptly. To avoid possible personal injury or damage to property under these conditions, disable the auto-guidance system and take manual control of the vehicle until conditions have cleared.

To engage the EZ-Pilot system, you must have:

- Have an open field in the Run screen
- Have an existing pattern you are using
- The vehicle within the engage distance set in the Engage tab. See Engage settings for EZ-Pilot system (page 168).

The Engage button on the screen can indicate status and, in some cases, also control the EZ-Pilot system.

When you are using EZ-Pilot, to automatically steer on the guidance line you can:

- Tap (yellow) on the screen
- Press the **Engage** button on the EZ-Remote joystick
- Use an external foot or rocker switch

Indicator/Button	Explanation	Tap to...
Ready to Engage (yellow)	The vehicle is close enough to the guidance line to engage on it.	Engage on the guidance line.
Engaged (green)	The vehicle is engaged on the guidance line.	Stop engaging on the guidance line.
Not Ready to Engage (red)	The vehicle is not ready to engage on the line because the guidance line is too far from the vehicle.	N/A. You cannot tap this button. It is an indicator only.
Auto steering not allowed (red)	Automatic steering is not allowed due to how it has been set up.	N/A. You cannot tap this button. It is an indicator only.

You can also Adjust EZ-Pilot guidance (page 364) settings during operations in the field.

Disengage EZ-Pilot system

The EZ-Pilot system can be disengaged automatically and manually.

Automatic disengagement

The EZ-Pilot system disengages automatically when:

- The vehicle is outside the engage distance set up in the Engage tab. See Engage settings for EZ-Pilot system (page 168).
- The system is paused.
- GPS positions are lost.
- The Minimum Fix Quality setting is set to a high accuracy correction method and the system receives low accuracy positions (such as no corrections).

Manual disengagement

To manually disengage the system, you can:

- Tap (green) on the screen.
- Press the **Engage** button on the optional remote control.
- Turn the steering wheel to override the electric motor.

  When you turn the steering wheel manually, the EZ-Pilot system disengages. It is recommended that you check this setting before you begin using the system in a new installation. To do so:

  a. Engage on a line.

  b. Turn the wheel until EZ-Pilot disengages.

  To make adjustments to the amount of force required to disengage the system using the steering wheel, see Steering performance calibration (page 170).

Adjust EZ-Pilot guidance

WARNING – Many large and sudden changes in satellite geometry caused by blocked satellites can cause significant position shifts. If operating under these conditions, auto-guidance systems can react abruptly. To avoid possible personal injury or damage to property under these conditions, disable the auto-guidance system and take manual control of the vehicle until conditions have cleared.

At the *Run* screen, tap . The EZ-Pilot panel displays.

Setting	Explanation
Nudge	The guidance line can move off target due to either: • GPS position drift after pausing or turning off the system • GPS satellite constellation changes as you drive in the field Use the < and > buttons to move the line in a perpendicular direction (left or right). To set the increment for this setting, see Steering settings for EZ-Pilot system (page 167).
Trim	Trim replaces Nudge when you are using RTK corrections. The vehicle can steer offline as a result of uneven drag on the vehicle from an unbalanced implement or from soil conditions. Use the < and > buttons to move the vehicle in a perpendicular direction (left or right) of the line you are currently engaged on. To set the increment for this setting, see Steering settings for TrueTracker system (page 249).
Online Aggr	Aggressiveness is the measure of how strongly the system makes steering changes. Use the - and + buttons to adjust how aggressively the vehicle moves to the guidance line. A setting that is: • Higher brings the vehicle back online faster, but may cause tight oscillations about the line • Lower: Brings the vehicle back online more slowly, but can avoid overshoot ***Note*** *– The default aggressiveness setting is 100%.*

EZ-Steer system operation

WARNING – Many large and sudden changes in satellite geometry caused by blocked satellites can cause significant position shifts. If operating under these conditions, auto-guidance systems can react abruptly. To avoid possible personal injury or damage to property under these conditions, disable the auto-guidance system and take manual control of the vehicle until conditions have cleared.

To engage the EZ-Steer system, you must have:

- Have a field open in the *Run* screen
- Have an existing pattern you are using
- The vehicle within the engage distance set in the Engage Options tab. See Engage settings for EZ-Steer (page 173).

The **Engage** button on the screen can indicate status and, in some cases, also control the EZ-Steer system.

When you are using EZ-Steer, to automatically steer on the guidance line you can:

- Tap (yellow) on the screen.
- Press the optional remote engage foot pedal.

Indicator/Button	Explanation	Tap to...
Ready to Engage (yellow)	The vehicle is close enough to the guidance line to engage on it.	Engage on the guidance line.
Engaged (green)	The vehicle is engaged on the guidance line.	Stop engaging on the guidance line.
Not Ready to Engage (red)	The vehicle is not ready to engage on the line because the guidance line is too far from the vehicle.	N/A. You cannot tap this button. It is an indicator only.
Auto steering not allowed (red)	Automatic steering is not allowed due to how it has been set up.	N/A. You cannot tap this button. It is an indicator only.

You can also Adjust EZ-Steer guidance (page 366) settings during operations in the field.

Disengage EZ-Steer system

The EZ-Steer system can be disengaged automatically and manually.

Automatic disengagement

The EZ-Steer system disengages automatically when:

- The vehicle is outside the engage distance set up in the Engage tab. See Engage settings for EZ-Steer (page 173).
- The system is paused.
- GPS positions are lost.
- The Minimum Fix Quality setting is set to a high accuracy correction method and the system receives low accuracy positions (such as no corrections).

Manual disengagement

To manually disengage the system, you can:

- Tap (green) on the screen.
- Press the **Engage** button on the optional remote control.
- Turn the steering wheel to override the electric motor.

  When you turn the steering wheel manually, the EZ-Steer system disengages. It is recommended that you check this setting before you begin using the system in a new installation. To do so:

  a. Engage on a line.

  b. Turn the wheel until EZ-Pilot disengages.

  To make adjustments to the amount of force required to disengage the system using the steering wheel, see Steering performance calibration (page 170).

When the system is not in use, hinge the motor away from the steering wheel and then secure it with the lock pin.

Adjust EZ-Steer guidance

WARNING – Many large and sudden changes in satellite geometry caused by blocked satellites can cause significant position shifts. If operating under these conditions, auto-guidance systems can react abruptly. To avoid possible personal injury or damage to property under these conditions, disable the auto-guidance system and take manual control of the vehicle until conditions have cleared.

At the *Run* screen, tap . The EZ-Steer panel displays.

Setting	Explanation
Nudge	The guidance line can move off target due to either: • GPS position drift after pausing or turning off the system • GPS satellite constellation changes as you drive in the field Use the **<** and **>** buttons to move the line in a perpendicular direction (left or right). To set the increment for this setting, see Steering settings for EZ-Pilot system (page 167).
Trim	Trim replaces Nudge when you are using RTK corrections. The vehicle can steer offline as a result of uneven drag on the vehicle from an unbalanced implement or from soil conditions. Use the **<** and **>** buttons to move the vehicle in a perpendicular direction (left or right) of the line you are currently engaged on. To set the increment for this setting, see Steering settings for EZ-Pilot system (page 167).
Online Aggr	Aggressiveness is the measure of how strongly the system makes steering changes. Use the **-** and **+** buttons to adjust how aggressively the vehicle moves to the guidance line. A setting that is: • Higher brings the vehicle back online faster, but may cause tight oscillations about the line • Lower: Brings the vehicle back online more slowly, but can avoid overshoot ***Note*** *– The default aggressiveness setting is 100%.*

GreenSeeker operation

The GreenSeeker system requires either of these to be activated for use:

- Field-IQ system
- Serial Rate Control system

Prior to using the GreenSeeker system:

1. Collect or input reference strip data.
2. Calibrate the system with either:
   - The boom mounted sensors on the RT200
   - The GreenSeeker handheld sensor
3. If you are using the RT200 interface module for variable rate control, set up the application equipment and rate controller to match the expected delivery rate commands.

Best practice

To ensure best performance from the GreenSeeker variable application system:

- Rinse the boom at the end of every day. Do this to keep the system clean and remove to any corrosive materials. Doing so will greatly extend the life of your machine.
- Do not use high pressure spray on the sensors when rinsing the machine. Even though all of the connectors and modules are fully sealed, there is the potential for leakage caused by the pressurized stream.
- Every time the spray tank is filled, take a soft cloth and wipe the lenses of the sensors. Try to check sensors at least once a day during full time operation.
- Be more aware of cleaning the sensors directly behind the machine.
- If you do not have ground protection devices on the boom (such as gauge wheels or skids) take extra care to not run the boom into the ground. Also, be aware of sensor vulnerability to stationary structures in the field.
- Sensors are usually mounted on the front of the boom and do not have rigid protection.
- Sensors should be re-calibrated after approximately 1000 hours of use due to possible changes in light output. This is generally done at the factory, or authorized service center.
- Sensors have an optimum operating range of 32" - 48" above the crop canopy. 38" is the optimum height, and must be measured from the top of the crop to the rectangular LED window of the sensor.
- Make sure all wiring harness components remain fastened to the boom as to not obstruct the view of the sensors and are free of any pinch points from boom folding and movement.

Variable rate setup

To set up variable rate application on the display:

1. Power up the RT200 interface module and the rate controller (if required).

   When the RT200 interface module is first powered on:

   a. The module's green power LED will blink three times accompanied by three beeps.

   b. The status LED will blink in time with each transmission of sensor data over the CAN bus.

      Expect to see a brief green flash, followed by a red flash at the I/M message rate (typically at 0.5sec). This indicates that data from the left (green flash) and right (red flash) CAN ports is being transmitted.

2. Activate GreenSeeker for use. See Activate features/plugins for use (page 45).
3. At the *Home* screen, tap .
4. At the *Configuration Selection* screen, tap **OK**.
5. At the *Field Selection* screen, load the field to be sprayed.

Create a custom table

Historical knowledge about the crop enables growers or crop consultants to determine different crop input requirements based upon biomass/size of the crop/plant. An example of this type of use would be variable rate application of:

- Defoliant in cotton
- Desiccant in potatoes

For these cases, the field is scouted (field calibrated) to determine areas of the field that require different rates of defoliant.

To obtain the NDVI values in representative areas of the field, you can use either:

- The RT200 system
- A GreenSeeker handheld

Using this data, you can create a table with NDVI values corresponding to application rates.

To create a custom table:

1. At the *GreenSeeker Calibration* screen, tap the Algorithm tab.
2. From the Formula list, select either:

   Custom Table: Manually enter NDVI calibration values (go to step 4)

Auto Calibration: The system automatically enters NDVI calibration values from the Calibration step by transferring the Maximum, Average, and Minimum NDVI values into rows two, three, and four respectively.

3. Tap the Number Of Rows entry box, enter a value and tap **OK**.

   The number of available NDVI and Rate values are dictated by the value entered in the Number Of Rows entry box.

   Typically the number of rows for the custom table are two more than the number of filed calibration areas sampled. This allows for starting at zero and ending at .99 NDVI.

4. Tap an NDVI entry box to enter a custom value.
5. Tap **OK**.
6. Tap a corresponding Rate entry box to enter a custom value.
7. Tap **OK**.
8. Select the Output tab.
9. From the Material Type list, select either Granular or Liquid.
10. Tap **OK**.

Calibrate GreenSeeker

In the GreenSeeker panel on the *Run* screen, the controls displayed depend on what you previously selected (for example, a crop algorithm or a custom table).

When you first open a new job or event and a crop algorithm has been previously used or selected, the Calibration Required message displays.

If you want to use a custom table, but see the Calibration Required message, tap **Edit**. See Create a custom table (page 369).

***Note** – If a custom table has been previously selected, the Calibration Required message will not display.*

Calibration steps

1. At the *Run* screen, tap . The GreenSeeker panel opens.
2. Tap **Calibrate**.
3. The GreenSeeker panel displays:
   - The buttons **Ref**, **Non-Ref** and **Done**
   - NDVI bar graph showing the real-time combined average NDVI from the RT200 module
4. Position the vehicle at the reference locations.
5. To record NDVI data from:

- The reference strip: Tap **Ref**, drive the reference strip and then tap **Ref** again to end recording.
- The non-reference strip: Tap **Non-Ref**, drive the nonreference strip and then tap **Non-Ref** again to end recording.

Note *– As the NDVI is collected, the data displays. Keep the vehicle moving as you collect the data. If you stop in one location, this will affect the average values. The* **Ref** *and* **Non-Ref** *buttons change to a lighter color when selected or active.*

6. Tap **Done**. At the *GreenSeeker Calibration* screen on the Calibration panel, values that were collected are displayed.

Setting	Explanation
Maximum	Reference: You can override the existing data and enter new data.
Average	Non-Reference or Reference: You can override the existing data and enter new data.
Minimum	Reference: You can override the existing data and enter new data.
Calibrate	**Non-Ref** or **Reference**: Tap to collect fresh data. You will not see the new values until you deselect the button you have tapped.

Note *– The reference values for Maximum, Average, and Minimum are also available for the Auto Calibration function on the Algorithm tab.*

7. When you are satisfied with the data on the Calibration tab, select the Algorithm tab.

   For Formula, select either:

   - An existing formula
   - Custom Table to create a new algorithm (see Create a custom table (page 369))

   Note *– The formula selected for your last job will still be current, so you are often just verifying that the correct formula is being used.*

   The values to be entered will change based upon the formula selected. Some values (such as Nitrogen Use Efficiency) have default values that are formula specific. You can change any value by tapping the entry box.

   Note *– You may need to reference the specific algorithms instruction for more detailed explanation of the CumGDD F, or similar fields. For example the CumGDD F for the corn v1.3 GrtPlns GDD OKState is Cumulative Growing Degree Days, Base 50F. For specific algorithm instructions, visit* www.GreenSeeker.com.
8. Tap **OK**.
9. Go to the Chart tab and enter the settings.

Setting	Explanation
Limit	Enabled: Disabled:
Max Limit	If necessary, enter a value based on rate controller or application equipment limitations.
Min Limit	If necessary, enter a value based on rate controller or application equipment limitations.

Note *– Maximum and minimum settings will limit the rate commands given to the rate controller.*

10. Review the application chart for each job to determine the appropriate nozzle selections and/or application equipment settings.
11. Tap **OK**.
12. Tap the Output tab.
13. From the Material Type list, select either Granular or Liquid.
14. Tap **OK**.

ISOBUS operation

With ISOBUS, you can use the FM-1000 integrated display to control an ISO-certified implement without an additional display. An ISO-certified implement has small computers called electronic control units (ECUs) which send signals to the FM-1000 integrated display. An ISO-certified tractor has a tractor ECU (TECU) installed on it. ECUs on implements enable you to control the operation:

- With the FM-1000 integrated display, using Task Controller (an optional feature). See Task Controller operation (page 373).
- With Virtual Terminal, an on-screen window opens so you can directly access the functions provided by the ECUs. See Virtual Terminal operation (page 374).

Task Controller operation

After you have activated Task Controller, displays on the *Run* screen.

1. If you are using one of the following models, you must tap the **Start** or **Auto** button in the Virtual Terminal screen before starting section and rate control using Task Controller.
   a. Tap to open the Virtual Terminal.
   b. Tap the appropriate button (**Start** or **Auto**).

Mode	Tap...
Kuhn Moduliner Seed Drill	**Auto**
Kverneland Exacta TL GEOspread	**Start**
Rauch/Kuhn AXIS-H-EMC	**Start**
Rauch/Kuhn AXIS-W	**Start**
Vicon RO-EDW GEOspread	**Start**

2. At the *Run* screen, tap on the right-hand side to display the Task Controller panel.
3. Tap to begin logging coverage.
4. Tap on the left-hand side to view the current section control.
5. To switch between the two target rates, tap the appropriate target rate button on the Task Controller panel.
6. To turn section control on and off, tap the Section Control **On** / **Off** button.

- When section control is off, use the Virtual Terminal for section control.
- When section control is on, sections will automatically turn off to limit multiple pass coverage.

Virtual Terminal operation

After you have activated Virtual Terminal, the button displays on the *Run* screen.

To access the *Virtual Terminal* screen:

- From the *Diagnostics* screen (under Configuration)
- By tapping on the *Run* screen. (This button displays on the *Run* screen after you have activated Virtual Terminal.)

Icon(s) on the left of the screen show the available ECUs. The center area and the buttons on the right of the screen change depending on information provided by the ECU.

***Note** – Virtual Terminal screens and functions vary by platform. For more information, refer to the equipment manufacturer's operating instructions.*

Remote Output operation

The FM-1000 integrated display automatically outputs pulses based on the settings in Remote Output settings (page 118) as well as Line feature settings (page 134).

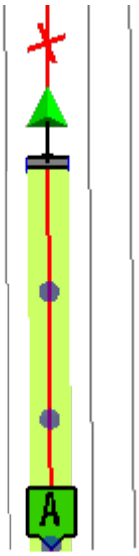
Distance-based pulse operation

With this option, pulses are output based on a specific distance you set up in Remote Output settings (page 118). You can use distance-based pulses with straight AB or A+ lines.

Within range limits

When you use remote output with distance-based pulses and you are within the limits of the range set in the Trigger Limits setting, your screen will show:

- The first dot for the first pulse output at the A point for the current swath
- Dots showing additional previous pulses
- A red X indicating where the system will output the next pulse



The Remote Output panel shows:

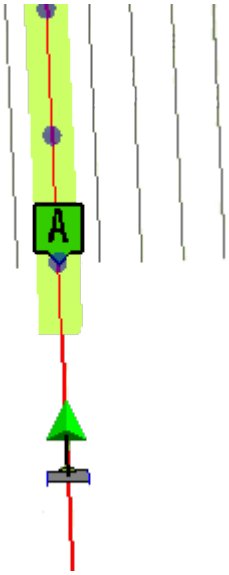
Remote Output Panel	Explanation
Next Output ID	A combination of the next pulse number and the current swath ID.
Current Pass Output	The number of pulses that have been output on the current swath.
Total Outputs	The number of pulses that have been output in the field currently.

Remote Output Panel	Explanation
Next Output Distance	The distance between the implement and the next point for the system to output a pulse.
Trigger Limits	The maximum number of pulses allowed per swath past the A point. This is set in Remote Output settings (page 118). You can also change this during operation. See Change trigger limits during operation (page 378).
Manual Trigger	Tap this button to manually output a pulse.

Outside range limits

When the vehicle and implement are outside the range limits:

- There is no red X on the screen.
- On the Remote Output panel, the Next Output ID shows n/a for both the next pulse number and the current swath ID.



Crossing a line feature operation

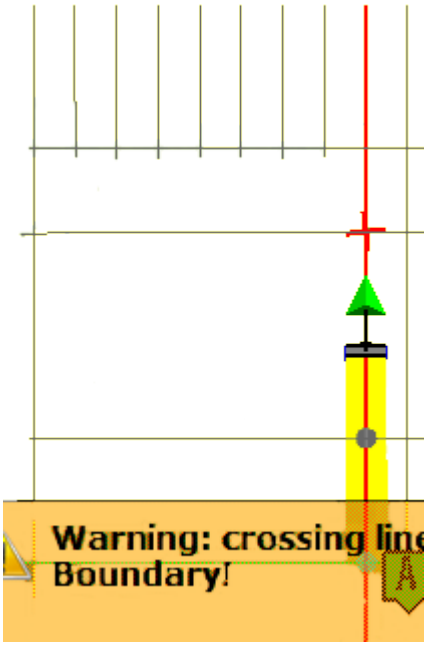
Using this option, a pulse is output at any point where the line you are engaged on intersects another line feature that has the remote output option enabled. See Line feature settings (page 134).

You can use this remote output option with AB/A+ lines as well as pivots and curves.

Your screen will show:

- Dots showing additional previous pulses
- A red X indicating where the system will output the next pulse

  Note *– The location of the next output may change as accuracy of the calculated position improves.*
- A warning when you near the intersecting line, if you have set up warnings (see Remote Output settings (page 118))



The Remote Output panel shows:

Remote Output Panel	Explanation
Next Output ID	A combination of the next pulse number and the current swath ID). (The pulse number increments with each pulse, and is not related to the swath or vehicle position.)
Current Pass Output	The number of pulses that have been output on the current swath.

Remote Output Panel	Explanation
Total Outputs	The number of pulses that have been output in the field currently.
Next Output Distance	The distance between the implement and the next point for the system to output a pulse.
Manual Trigger	Tap this button to manually output a pulse.

Change trigger limits during operation

To change the maximum number of pulses per swath during operation, tap the button to the left of the label Trigger Limits and enter the new number.

Manually output a pulse

To manually output a pulse, tap .

To set the color of the dot that indicates a manual pulse, see Remote Output settings (page 118).

Row Guidance operation

WARNING – Many large and sudden changes in satellite geometry caused by blocked satellites can cause significant position shifts. If operating under these conditions, auto-guidance systems can react abruptly. To avoid possible personal injury or damage to property under these conditions, disable the auto-guidance system and take manual control of the vehicle until conditions have cleared.

With Row Guidance, the information from existing sensors installed on the combine heads are used to automatically adjust the combine response to changes in the row position.

Row Guidance is used with the Autopilot system to help center the combine on the crop rows when they are are not aligned with the guidance line used to plant the crop (caused by planter drift or environmental damage).

Row Guidance enables you to:

- Increase corn yield through reduced ear loss
- Reduce operator fatigue in difficult conditions (such as down corn, curved rows, long passes and other poor visibility conditions)
- Operate effectively in fields that were planted using other steering systems or in areas where the planter drifted

You can operate Row Guidance with:

- Straight lines: You can use either A-B or A+ lines.
- FreeForm patterns: When recording and in corn rows, the Row Guidance sensors drive the firsts pass. After that, the guidance system uses the previously recorded pass but augments it with sensor input.
- Curves: When operating on a sharp curve, Row Guidance aggressiveness may need to be increased for performance. See Row Guidance adjustments (page 382).

To open the Row Guidance panel, at the *Run* screen tap .

Use row sensors

To use the sensors:

1. Make sure the Autopilot system is engaged.
2. Activate the sensors by tapping on the Row Guidance panel.

   When active, the row guidance sensors will feel the number of "strikes" against them. After a set number of strikes, the Row Guidance will determine the average peak displacement of the sensors on each side of the row for the strikes and react to this peak displacement on each side to steer the vehicle until the peak displacements on each sensor are equal.

   Note *– Row sensors override the set Autopilot guidance line. When you turn around in headlands with the sensor turned on, random strikes on stubble cause the system to veer off the set Autopilot guidance line. It is recommended that you travel through the headlands with Autopilot only to guide to the proper row. After you enter the unharvested crop, activate the sensors for row guidance.*

On the Row Guidance panel, the sensor button/indicator shows the status of the sensors.

Indicator/Button	Explanation
(Yellow)	Row sensors are on but not active.
(Green)	Row sensors are on and active. Tap to turn sensors off.
(Gray)	Row guidance sensors are off. Tap to turn row guidance sensors on and off while the Autopilot system is engaged. The guidance system will now function as a traditional Autopilot system
	There is an error with the sensors.

Shift or skip guidance line

You may need to skip the guidance line to coordinate with the crop and guidance line if you operate in a crop that was planted:

- Without automatic steering
- Using WAAS corrections and is being harvested using WAAS guidance

In either case, satellite drift and/or operator guidance can lead to misalignment of the guidance line with the crop. Depending on conditions, it may be necessary to shift or skip the guidance line to coordinate with the crop and guidance line. This will be evident when the sensors guide down the proper row with offline distance is shown to be 0, but the selected guidance line is not centered on the current swath on the screen.

In this case it is recommended to skip (temporarily move the guidance line) to align with the drifted crop rows. The Autopilot system must be disengaged to skip.

Row Guidance adjustments

On the Row Guidance panel, you can adjust guidance using the following controls.

Control	Explanation
Nudge	Use to correct satellite drift. Nudge adjustments are available for autonomous, WAAS, Omni, and RTX Rangepoint corrections. This adjustment will move the position of the vehicle in the global (cardinal) direction perpendicular to the path traveled in the user defined increment. When a correction is made heading South on a guidance line to the right, the position of the vehicle will be moved to the West. When heading back North, the correction will still be to the West but left to the direction of travel.
Trim	The vehicle can steer offline as a result of: • Uneven drag on a vehicle from an unbalanced implement • Uneven drag on a vehicle from soil conditions Trim adjustment is available for RTK and RTX Centerpoint corrections (FS, SS, SC). Trim moves the vehicle perpendicular to the line with reference to the forward direction (to the right or left of vehicle forward travel) the amount setup by the user. For example, while traveling South down a line and the trim is moved 1 inch right (West), when the vehicle is turned around and driven north the correction will still be right of the line which is East on the Northern heading.
Steering Aggressiveness	Use the - and + buttons to adjust how aggressively to command the steering to the guidance line. Aggressiveness should not be set too high. This can cause the vehicle steering not to react to commands (the steering wheels cannot react fast enough to keep up with the steering commands). Instability in steering will result.
Row Guidance Aggr	Use the - and + buttons to adjust how aggressively the vehicle reacts to the input from the Row Guidance sensors.

TrueTracker operation

WARNING – Many large and sudden changes in satellite geometry caused by blocked satellites can cause significant position shifts. If operating under these conditions, auto-guidance systems can react abruptly. To avoid possible personal injury or damage to property under these conditions, disable the auto-guidance system and take manual control of the vehicle until conditions have cleared.

When using TrueTracker with the Autopilot system, the implement receives its own separate guidance and steering to increase accuracy.

TrueTracker controls

To open the TrueTracker panel, tap .

Control	Explanation
Nudge	The guidance line can move off target due to either: • GPS position drift after pausing or turning off the system • GPS satellite constellation changes as you drive in the field Use the < and > buttons to move the guidance line in a perpendicular direction (left or right).
Aggr	Use the - and + buttons to adjust how aggressively the implement moves to the guidance line.
Zero Steering	Off: Zero Steering is not used. On: Commands the steering to zero degrees left/right, centering the steering device on the implement. This option can be turned on in the field, keeping the coulters pointed straight, or just at the ends of the field to center the steering. ***Note*** *– Disengaging the TrueTracker system automatically turns off Zero Steering.*
Engage (Green)	For the main button color: Vehicle steering is engaged. For the smaller inner color on the button: Implement steering is engaged. For settings on Engage, see Engage settings for TrueTracker system (page 248).
Engage (Red)	For the main button color: Vehicle steering cannot engage. For the smaller inner color on the button: Implement steering cannot

Control	Explanation
	engage. For settings on Engage, see Engage settings for TrueTracker system (page 248).
Engage (Yellow)	For the main button color: Vehicle steering is ready to engage. For the smaller inner color on the button: Implement steering is ready to engage. For settings on Engage, see Engage settings for TrueTracker system (page 248).

Implement status

GPS status

Tap the second to view status on the implement receiver:

- Implement GPS Status
- Implement Correction Type
- Implement Correction Age
- Latitude
- Longitude
- Altitude
- Satellites
- HDOP
- VDOP
- Network ID

Text

A number of status text items provide information about the implement. You can set these status text items to appear permanently at the top of the screen or on a slide-out tab. To set up status items, see Status items (page 64).

Implement on-screen lightbar

When implement steering is enabled, a second, smaller lightbar displays on the screen below the main lightbar.

The lower lightbar shows the implement guidance relative to the guidance line. Each LED on the second lightbar represents 1 inch.

TrueGuide operation

WARNING – Many large and sudden changes in satellite geometry caused by blocked satellites can cause significant position shifts. If operating under these conditions, auto-guidance systems can react abruptly. To avoid possible personal injury or damage to property under these conditions, disable the auto-guidance system and take manual control of the vehicle until conditions have cleared.

TrueGuide uses a second GPS receiver on the implement to enable the Autopilot system to pull the implement onto the guidance line.

To open the TrueGuide panel, at the *Run* screen, tap .

Control	Explanation
Trim	
Aggr	Adjust aggressiveness during operation. Use the - and + buttons to adjust how aggressively the implement moves to the guidance line. • To increase the response to move the implement back to the line, increase aggressiveness. • To smooth the response to the implement moving offline, decrease aggressiveness
	The recommended settings for default values are: • For steep slopes (10% - 30%): 150% • For slow speed applications: 125% • For normal operation: 100% • For high speed applications (>8 mph): 33%
TrueGuide engagement	On: When the right-hand button displays ON, the Autopilot system is engaged. Auto: When the right-hand button displays AUTO, the TrueGuide system is engaged. Off: Tap to disengage the TrueGuide system.

Using TrueGuide

1. At the *Run* screen on the TrueGuide panel, tap (yellow). The right-hand button changes to **ON** and the TrueGuide status changes to Waiting.

   The Autopilot system acquires the line before transitioning to the TrueGuide system.

   The TrueGuide system status remains at Waiting while the Autopilot system acquires the line.

   After the TrueGuide system has taken control, its status changes to ON and the right-hand button changes to **AUTO**.

2. To disengage the TrueGuide system at anytime, tap **OFF** (the left-hand button).

   Note *– As soon as the TrueGuide system is disengaged, the Autopilot system immediately begins providing all guidance.*

Note *– To turn on the TrueGuide system when the status is Waiting, tap* **ON** *again.*

TrueGuide system status indicators

The system status displays on the TrueGuide tab between the **Off / On (Auto)** buttons.

TrueGuide Status	Expanation
Off	The TrueGuide system is off.
Disengaged	The TrueGuide system is ready, but not engaged.
Waiting	The Autopilot system is engaged, and the TrueGuide system is preparing to engage after a short pause.
On	The TrueGuide system has engaged and is on.

Vehicle Sync operation

Vehicle Sync replaces the transfer of data using a USB drive. Instead, data is transferred wirelessly between vehicles. Real-time, up-to-date information improves operational efficiency and accuracy. Multiple operators belonging to the same WorkGroup in the same field can transfer location information on other vehicles and:

- Point/line/area features
- Coverage mapping and implement section switching
- Productivity and operational statistics and conditions

Vehicles using Vehicle Sync can also share data on:

- Yield and moisture
- Tank levels
- Location and speed

Common uses

You can use Vehicle Sync for:

- Same operation: Multiple vehicles and implements in a Vehicle Sync WorkGroup performing the same tasks (such spraying, planting or harvesting)
- Same field, different operation: Multiple vehicles and implements performing different tasks (such as a sprayer working with a planter or a harvester working with a grain buggy)
- Observation: A vehicle can see the location and productivity of the WorkGroup, but does not share coverage, lines or points.

Benefits

Vehicle Sync assists in:

- Planting: Using Field-IQ provides clutch triggering based on coverage sharing, which maximizes input conservation.
- Spraying: Sharing tank level and as-applied information
- Harvesting: Maintaining yield-to-area integrity within the harvest data, and sharing instant yield and moisture information

Using Vehicle Sync

Up to six vehicles can join a Vehicle Sync WorkGroup by joining the same channel.

Join a WorkGroup

To sync with a specific vehicle, make sure:

- Your vehicle has a clear line of sight with that vehicle.
- You are within a distance of 325 yards (300 meters) from that vehicle.
- At least one vehicle is working in an open field.

To link with a vehicle, see .

Guidance lines with Vehicle Sync

You create guidance lines as normal (with the exception of adaptive curves and Free Form lines that are not supported by Vehicle Sync).

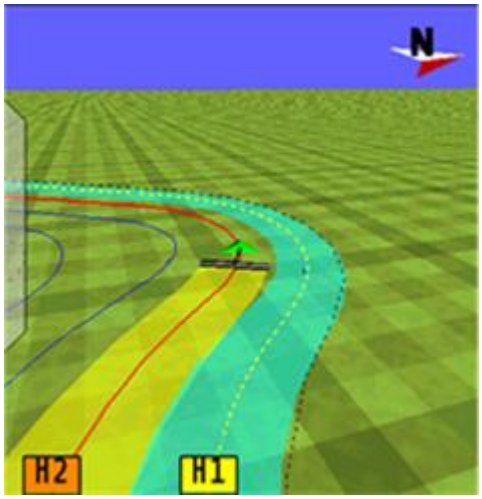
Naming guidance lines

To avoid any confusion, it is recommended that you take care in naming guidance lines. All guidance lines are automatically combined together, including lines that vehicles possessed prior to linking. If guidance lines have the same name prior to linking (for example, if both vehicles have a line called *AB line 1*), Vehicle Sync reviews the lines to determine whether they are the same or different:

- If they are exactly the same, they are not duplicated.
- If there is a difference, the lines are pooled and labeled with the tractor from which they have come (for example, for both Tractor A and Tractor B, *AB line 1* will be relabelled in all guidance line pools as *AB Line 1 Tractor A* and *AB Line 1 Tractor B)*.

Note *– Vehicle Sync will not shift lines to account for different implement widths. The actual line is transferred.*

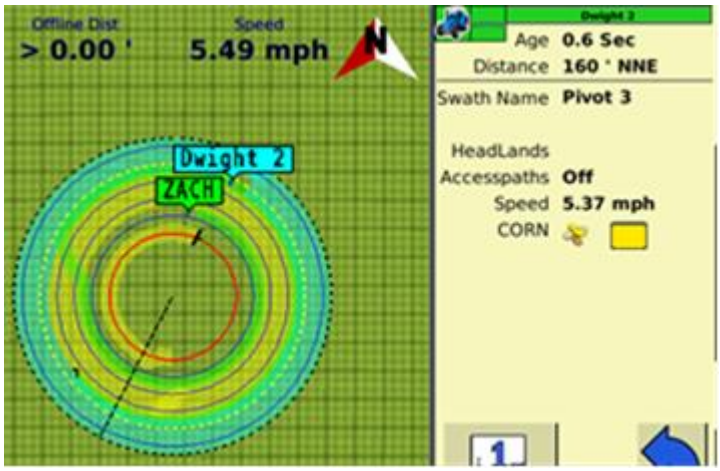
If you are performing an operation in which all vehicles have the same swath width and use the same guidance line, the line on which the other vehicle is engaged becomes dotted, as shown for H1:



Although you can engage on this line, an alert will display to inform you that you are engaged on the same line as another vehicle.

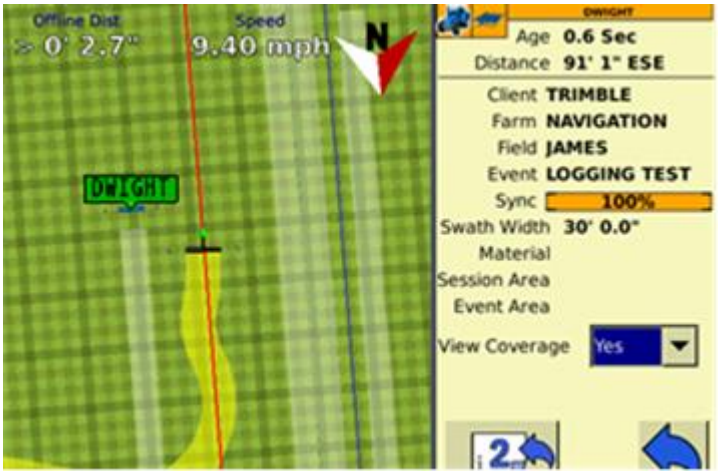
Coverage

Your vehicle coverage is colored yellow on the screen. When the vehicle sync layer is selected (for events that have the same Client/Farm/Field/Event), the coverage associated with other vehicles will be color coordinated to that vehicle.

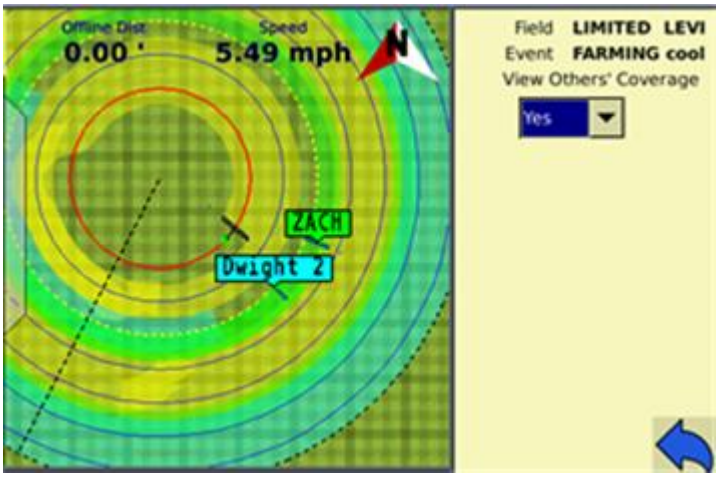


View only layer

When vehicles are not in the same event, a *View Only* layer is shown for those vehicles that does not affect section control.



There is also the option to show only the coverage logged by the your vehicle.



Coverage controls the following:

- Tru Count clutches
- Liqui-Block clutches
- “Rate as” section
- Header swath width for yield calculation
- Sprayer sections

Note *– The warning Event Memory Low displays when the size of the file in the current event exceeds the memory capacity of the display. If this warning displays, exit the current field and begin a new event with a similar name.*

Water Management functionality

The functions you can perform with Water Management features include:

- Create a survey (page 392)
- Create / save a design (page 395)
- Leveling (page 396)
  - Point and Slope mode (page 397)
  - Flat Plane (Laser) and Flat Plane (GPS) modes (page 398)
  - Contour mode (page 402)

For dual or tandem operations, there are:

- Dual scraper controls (page 408)
- Tandem scraper controls (page 409)

Create a survey

The steps to create a survey are:

1. Create benchmarks (page 392).
2. Survey the field (page 393).

Create benchmarks

Before you can create a survey, you must set a point at a known location called a benchmark. When you create a benchmark, the GPS receiver obtains and records location information from the base station for that specific point in your field.

When you are leveling, you use benchmarks to:

- Return to a point in the field with known coordinates to re-calibrate your exact position. This may include setting the bucket on the ground or on a solid surface that will not be disturbed while you perform field leveling.
- Move the design up or down to match the field surface at that point.

The first benchmark you create on a field is the master benchmark and displays as an orange flag labeled **MB** . Field coordinates are calculated from this point.

Subsequent benchmarks display as orange flags labeled with their corresponding number .

Bechmark steps

1. Place the GPS antenna in a known, repeatable location that will not change throughout the leveling of a field.

   Tip – Mark this location with flags or some other marker so that you can return to the exact spot.

2. Stop the vehicle.
3. On the WM-Survey tab, tap **Bench**.

   Note *– If FieldLevel II is installed, you can tap* **Bench** *on that instead. Both* **Bench** *buttons have the same effect.*

   A countdown timer runs for 30 seconds and then the system creates the benchmark. To stop the averaging during the countdown, tap **Bench** again.

   Note *– If you are within the circle around an existing benchmark, a new mark is not created.*

Survey the field

After you create the benchmark(s), collect field layout data by conducting a survey.

Define the boundary

Define a boundary to establish the confines of your field. Drive around the boundary while you record the shape.

1. At the *Run* screen, tap to open the Survey/Design panel.
2. Before driving the boundary, select the reference point you want to use for recording the boundary.
   - Center: Records the boundary based on the location of the antenna.
   - Left: Records the boundary offset half of the implement width to the left of the direction of travel.
   - Right: Records the boundary offset half of the implement width to the right of the direction of travel.
3. Select Boundary from the list.
4. Tap **Record**.
5. Drive the boundary while recording. The boundary records with a line showing it begins and ends at the starting point. (The boundary is a complete loop.)
6. After you have driven to the end of the boundary, tap **Record** again.

Define interior points

To complete a full survey, create guidance lines and then drive over all of the interior of the field boundary, while the system records interior points.

1. At the Survey/Design panel, select Interior from the list.
2. Tap **Record** and drive around the interior of the field, gaining enough coverage to produce a height map. You can change the data logging intensity in the FieldLevel II Survey/Design settings (Coarse = 25 ft; Medium = 10 ft; Fine = 5 ft).

Define a section (optional)

After you create a boundary, you have the option to create sections that split the entire area into portions. This enables you to create a design for each section instead of the entire area.

Sections can be useful after you finish working on the area for the day. Define the area that you completed as a section. When you return to the area, you can level the remaining area to a second best-fit plane. See Design (page 394).

There are two methods for defining a section.

- Method 1:
  - Begin recording the section line outside the boundary.
  - Drive through the field to define the section line, then cross outside the boundary again.
  - The section is defined.
- Method 2:
  - Record a section line inside the boundary.
  - The ends of the line will extend to meet the boundary.

Design

After you have completed the survey, the system can create the design based on the information gathered by the survey and the settings you enter as part of the design process. FieldLevel II defines the three-dimensional height for the field and controls how the implement reshapes the ground.

The Autoplane functionality uses the topographic survey of your field to estimate its surface elevations.

You can accept the AutoPlane calculation and have the system create a best-fit design, or manually edit settings, including:

- Cut/Fill ratio: Amount of cut dirt that equals one volume of fill dirt.
- South --> North Slope: Angle of the slope from North to South.
- West --> East Slope: Angle of the slope from West to East.

- Composite Slope: The true angle of the fall of the design. In other words, the angle of the slope when the two slope angles are combined.
- Slope Heading: The heading direction of the slope when the East/West and North/South slopes are combined.

Create / save a design

After you complete the survey, the **AutoPlane** button displays on the Survey/Design panel.

To create a design for the optimum slope for your field that requires the minimum amount of dirt to be moved:

1. Tap **AutoPlane**. The *AutoPlane* screen displays.

   If necessary, you can manually adjust the angle of the slope. However, this may require a greater amount of dirt to be moved because the original design was the optimum.

2. Complete the settings.

   If necessary, you can manually adjust the angle of the slope. However, this may require a greater amount of dirt to be moved because the original design was the optimum.

Setting	Explanation
Cut/Fill Ratio	The amount of cut material that equals one volume of fill material.
Section	If you set up sections when you defined the field, you can select a section from the list. • None: Levels the entire field. • Left: Levels only the section to the left of the section line. • Right: Levels only the section to the right of the section line.
Composite Slope	The true angle of the fall of the design when the East/West and North/South slopes are combined.
Slope Heading	The heading direction of the slope when the East/West and North/South slopes are combined.
North -> South Slope	The angle of the design slope from North to South.
East -> West Slope	The angle of the design slope from East to West.
Height or Cut/Fill	Height: Gives the design the theme of a topographic height map. Cut/Fill: Gives the design the theme of a cut/fill map. Red indicates the cut areas. Blue indicates the fill areas. Green indicates areas that do not need cut or fill.

3. Tap **Best Fit**.

The system uses the interior points that you collected to calculate the optimum slope of the field. An arrow displays on the image of the field to show the direction of fall. The Stats table lists the statistics of the design computation:

- Cut: The volume of material that must be removed for the current design.
- Fill: The volume of material that must be added for the current design.
- Area: The area of the field inside the boundary.

4. Tap **OK** to close the AutoPlane screen and save the design. The the system saves the design as the default plane for this field.

Leveling

Before you begin your leveling operation using Field LevelII, you may need to:

- Import designs (page 403)
- Reload a field (page 403)
- Re-bench (page 403)

Getting started with leveling

The FieldLevel II system automatically raises and lowers the blade on the implement to match the design height anywhere in the field. You will use the color cut/fill map, simple on-screen adjustments, and automatic blade control to perform leveling.

In addition to the following instructions, depending on where you are in your operation, you may need to:

- Reload a field (page 403)
- Re-bench (page 403)

1. Open a field as normal.
2. When your leveling model is set to Multiplane design and the FM-1000 integrated display opens the field, the system:
   - Scans the \AgGPS\Designs\.
   - Opens any Multiplane .gps control files that are close to your current position and displays a list of these files in the *Select Design* screen.
3. Select the design you want to use and tap **OK**.
4. To enter the leveling panel, tap either or , depending on whether you are using a tandem scraper or dual scraper. See Dual scraper controls (page 408) or Tandem scraper controls (page 409).
5. Determine which leveling model you want to use:

- Point and Slope mode (page 397)
- Flat Plane (Laser) and Flat Plane (GPS) modes (page 398)
- Define a plane (page 399)
- Contour mode (page 402)

Leveling models

You have different leveling options, depending on the leveling mode that you selected:

- Point and Slope mode
- Flat Plane (Laser) and Flat Plane (GPS) mode
- Contour mode

Point and Slope mode

Slope is the percentage of vertical drop compared to horizontal travel. A positive slope goes upward, and a negative slope goes downward. For example, if the slope is set to -1%, the slope will drop 1 ft for every 100 ft horizontally traveled.

When you drive in Point and Slope mode, the Leveling panel displays the following controls.

Button	Explanation
Coarse / **Fine**	Coarse: The blade will move by large increments. Fine: The blade will move by small increments.
Edit	Tap to view or change the Slope Adjust increment. This setting controls the amount the gradient changes each time you increase or decrease the design slope. For example, if the leveling gradient is set to -3%, and the slope adjust is set to 2%, when you decrease the design slope amount, the leveling gradient decreases to -5%.
	Tap to increase the design slope by the Slope Adjust increment.
	Tap to decrease the design slope by the Slope Adjust increment.
Bench or **Re-Bench**	Tap to create a benchmark or re-bench. Set the Design Height equal to the Blade Height.
Delete Benchmark	Tap to remove any benchmark on the field that you have selected. You do not need to drive over a benchmark to delete it.
Logging	Tap to log coverage. This shows on the map where you have been, dependent on your implement width. A shape file is created with cut/fill and height information.

Button	Explanation
Auto	Engages automatic blade height control: • Starts the slope calculation • Resets the height • Resets the cut/fill

Flat Plane (Laser) and Flat Plane (GPS) modes

When driving in Flat Plane mode, these options operate the same:

- Flat Plane (Laser): Use this model when the land has previously been leveled with a laser system and you want to touch up the field. This model results in a mathematically flat surface (which means the plane does not follow the curvature of the Earth, but completely flat).
- Flat Plane (GPS): Results in a design with a surface that is curved the same as the surface of the Earth (an equipotential surface).

Note *– Neither of these models can be used with a laser system. The entire FieldLevel II system only works with GPS.*

The controls on the Leveling panel for these modes are:

Button	Explanation
Coarse / **Fine**	Coarse: The blade will move by large increments. Fine: The blade will move by small increments.
	Raises the blade by the fine or coarse increment.
	Lowers the blade by the fine or coarse increment.
Design	Tap to open the Plane Editor. Here you can edit the design plane.
Bench or **Re-Bench**	Tap to create a benchmark or re-bench. Set the Design Height equal to the Blade Height.
Delete Benchmark	Removes any benchmark on the field. You do not need to drive over a benchmark to delete it.
Logging	Tap to log coverage. This shows on the map where you have been, dependent on your implement width. A shape file is created with cut/fill and height information.
Auto	Engages automatic blade height control: • Starts the slope calculation

Button	Explanation
	• Resets the height • Resets the cut/fill

Define a plane

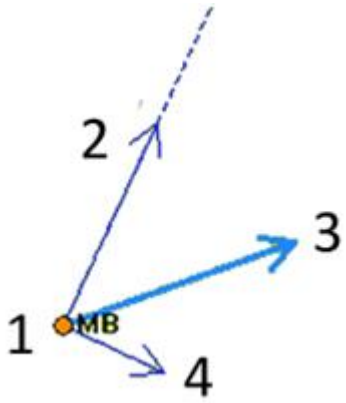
You can define a plane in the *Plane Editor* screen. The controls on the Plane Editor screen enable you to either:

- Design a field slope and orientation
- Set the design parameters for the tile or surface ditch profile

To define a plane, you can use:

- A single point
- Multiple benchmarks

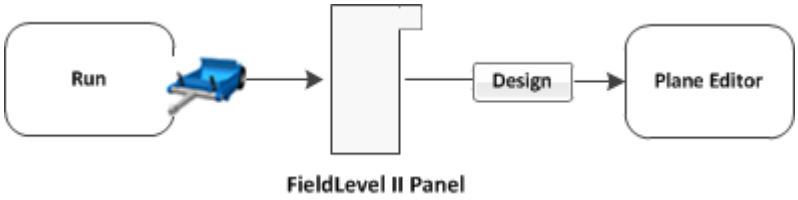
Use at least one point as a pivot point and extra information based on direction and slope requirements.



Item	Name	Explanation
1	Pivot Benchmark	The single benchmark where the plane is defined. All slopes will pivot around this point.
2	Primary	The first axis upon which the slope is defined. It has a Primary Slope and Primary Heading component. The Primary Slope is defined as a negative number, where water will fall along the primary axis.
3	Cross	The second axis upon which the slope is defined. The Cross Heading will always be 90° or 270° from the Primary Heading. The Cross Slope is defined as a negative number, where water will fall along the cross axis. To define the plane by a single heading and slope, then you should set

Item	Name	Explanation
		the Cross Slope value to 0.000%
4	Composite	When both Primary and Cross slopes are defined, the Composite Slope direction shows the actual heading where water will fall. If you have 0.000% slope on the Cross axis, the Composite Heading will be the same as the Primary Heading.

Use a single point



To define a plane using a single point:

1. At the FieldLevel II panel, create a benchmark to define the direction of the slope and its heading.

   It can be useful to create the benchmark at the critical point. For example, where the water will enter or exit the field. This ensures that where the benchmark is, the plane is on grade.

2. Tap **Design**. The *Plane Editor* screen displays. Complete the settings and tap **OK**.

Item	Explanation
New Plan	
Choose Pivot	Tap and select the benchmark you want to be on grade.
Primary Slope	If you want to define the primary heading by measuring a second point, see Define a plane (page 399).
Cross Slope	
Height Above Pivot	Enter the known offset if you are using one.
Primary Heading	
Flip	Tap to change the direction of the Cross Slope. This changes the Cross Heading between 90° and 270° from the Primary Heading.

For water to run along the Primary and Cross axis, the slope values must be keyed in as negative values.

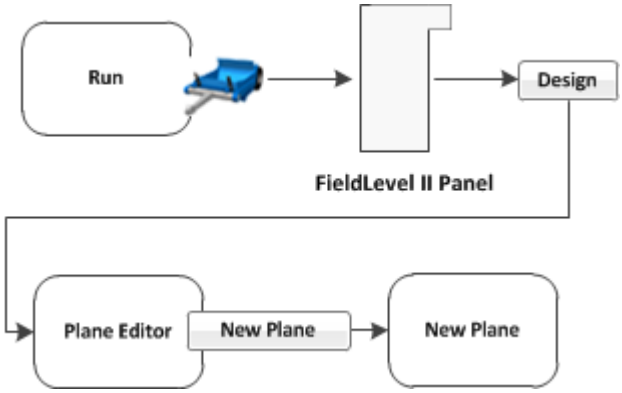
Note *– FieldLevel II searches for a survey on the field. If there is a survey, a Cut/Fill map displays on the new design plane.*

Use multiple benchmarks

You can use multiple benchmarks to define a plane based on your specific requirements. If multiple benchmarks are created, you can design a plane of best-fit through them.

If you use three benchmarks to design the plane, the cut and fill values will be "0.0" through those points so the system can create a perfect plane. If you use more than three benchmarks to design the plane, the cut/fill values will be the residual difference between the plane of best-fit and the benchmark elevations.

To define a plane using multiple points:



1. At the FieldLevel II panel, create two or more benchmarks to help define the plane. If a primary heading definition is required you only need two benchmarks. If all the slopes of a field are to be defined, then you need at least three benchmarks. Select the FieldLevel II plugin and tap **Design**. The *Plane Editor* screen displays.
2. Tap **New Plane**. The *New Plane* screen displays.
3. From the Benchmarks list, select the benchmark you want to use for the primary pivot, then tap **Add**. The benchmark is copied to the Design Benchmarks list.
4. Repeat the previous step until all the required benchmarks are copied to the Design Benchmarks list. The Design Benchmarks list contains the benchmarks for the multi-point plane.
5. Set the Primary Slope Heading:
   a. Choose the first benchmark to define the heading and then tap the **Set>** From: button.

      Note *– It is recommended that this point is the uphill point of the two points that will be used to define the primary slope.*

   b. Select the second point of the primary slope and then tap the **Set>** To: button.
   c. Tap **OK**. The Plane Editor screen displays.

      The selected benchmarks appear in the Benchmarks table on the upper left along with their associated cut/fill values. The Primary Slope and Cross Slope values reflect the calculated slopes based on the benchmarks entered in the *New Plane* screen.
6. To update the slope values:

a. Identify the benchmark to be used as the new pivot.

b. Tap **Choose Pivot**. The *Choose Pivot* screen displays.

c. Select the benchmark to be used as a the pivot for the new slope from the screen.

d. Tap **OK**. The *Plane Editor* screen displays.

7. Select the Primary Slope, Cross Slope, or Height Above Pivot areas to edit the slope values as required.

   Note *– The cut/fill values in the Benchmarks table will update automatically.*

8. The plane is now defined. Tap **OK**. The *Run* screen displays.

   Note *– The FieldLevel II system will search for a survey on the field. If there is a survey, a cut/fill map displays as the new design plane.*

Contour mode

1. At the *Run* screen, drive the vehicle to the location where you want to start the first levee.
2. Set the master benchmark at this point.
3. Set which side of the vehicle is uphill.
4. Tap **Guide** and drive the vehicle forward, following the lightbar to keep the vehicle on the same contour.

   a. To move to the next levee, turn the vehicle around and change the Up Hill direction.

   b. To step the blade up or down, use the and plus and minus buttons to achieve the required offset and then follow the lightbar to keep the correct grade.

When you drive in Point and Slope mode, the FieldLevel II panel displays these controls.

Button	Explanation
Coarse / **Fine**	Coarse: The blade will move by large increments. Fine: The blade will move by small increments.
	Raises the blade by the fine or coarse increment.
	Lowers the blade by the fine or coarse increment.
Up Hill Left	Select if you are driving around the contour with the uphill slope on your left and the downhill slope on your right.
Up Hill Right	Select if you are driving around the contour with the uphill slope on your right and the downhill slope on your left.
Bench or **Re-Bench**	Tap to create a benchmark or re-bench. Set the Design Height equal to the Blade Height.

Button	Explanation
Delete Benchmark	Removes any benchmark on the field. You do not need to drive over a benchmark to delete it.
Logging	Tap to log coverage. This shows on the map where you have been, dependent on your implement width. A shape file is created with cut/fill and height information.
Guide	Tap to get lightbar guidance at the current level.

Import designs

After you finish with your design, you can export a control file (.GPS) for use with the FieldLevel II system. Copy the design control file into the \AgGPS\Designs\ folder on a USB drive.

Reload a field

When you create a design for a field (for example, a target leveling plane), the design is saved in the */field/* directory.

The design files are associated with the field. If you close the field and then open it again, the design reloads with the field.

With RTK GPS, the position of the RTK base station is important to the heights used when the field was previously open. If the base station is not accurately positioned in the same physical location, you must reestablish the design over an existing benchmark to re-establish the height.

Re-bench

When you are leveling, you use benchmarks to:

- Return to a point in the field with known coordinates to re-calibrate your exact position. This may include setting the bucket on the ground or on a solid surface that will not be disturbed while you perform field leveling.
- Move the design up or down to match the field surface at that point.

Re-benching is designed to accommodate differences with RTK base station setup from the last time the field was opened.

Manual re-bench

On the Field LevelII panel, if you tap either of the **Re-bench** buttons when the receiver is within the circular radius of a benchmark, the receiver is calibrated over the existing benchmark. Re-benching enables you to synchronize your position with the design you created.

1. Tap **Re-Bench**. A message displays showing a list of the saved benchmarks within the open field.

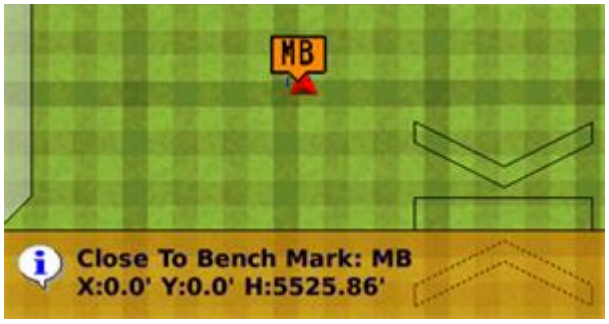
   The system automatically selects the benchmark closest to you (if multiple benchmarks exist), but allows you to select the benchmark you want to use.

   Note *– To ensure the design is properly aligned to the field, return to the exact location of the master benchmark that you marked on the ground (for example, with flags, see* *Create benchmarks (page 392)**), and re-bench on the master benchmark.*

2. Select the benchmark to re-bench on.
3. Tap **OK**. A confirmation message displays showing the calculated distance to the selected benchmark.

   Note *– This calculation may be quite exaggerated if the base was moved a considerable distance away from its previous position.*

4. Verify this is the benchmark you want (if multiple benchmarks exist).
5. Tap **OK** to accept the message. The system begins the standard 30-second averaging process to re-establish the field relevance to the benchmark you just re-benched on.



Force re-bench

If you open a field that has an existing master benchmark and have chosen to require Force Rebench (see Relative Heights tab (page 272)), the **Create Benchmark** button label changes to **Re-Bench**. The system will not allow you to engage automatic control until the system has been re-benched.

Note *– You must locate the machine exactly over the actual mark on the ground.* ***Do not*** *rely on your relative position to the master benchmark if the base station was moved.*

Blade level indicators

In the operational view of the *Run* screen, a blade indicator shows the status of the blade related to the On-Grade Limit.

Indicator	Explanation
	The blade is above the target height beyond the On-Grade Limit.
	The blade is below the target height beyond the On-Grade Limit.
	The blade is considerably above the target height, more than double the On-Grade Limit.
	The blade is considerably below the target height, more than double the On-Grade Limit.
	The blade is at the correct target height, within the On-Grade Limit.

When you are using dual or tandem scrapers, you will see two blade indicators on the *Run* screen.

Additionally, you can tap to open the legend for the operational view of the *Run* screen and select either Height or Cut/Fill.

FieldLevel II status items

Status items are text information that:

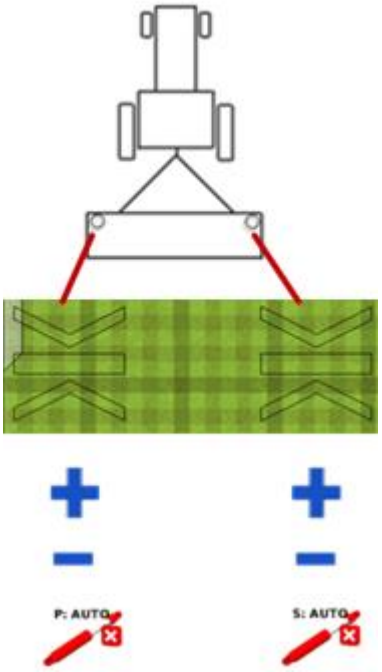
- Describe factors in leveling models
- Beginning with P are for the primary GPS receiver (for example, P Blade Height)
- Beginning with S for the secondary if you are using dual or tandem scrapers (for example, S Blade Height)

Status items can be set to always display at the top of the screen or on a slide-out tab. See Status items (page 64).

Status Item	Explanation
Altitude	Current GPS altitude of the blade.
Blade Height	Current height of the blade shown as a relative height or a GPS height depending on settings selected.
Boot Depth	Depth of the boot when installing tiles or the depth of the blade when cleaning surface ditches (used with the Autoslope leveling model).
CMR Percent	Percentage of data being successfully received from the base GPS receiver.
Correction Age	Time since the last GPS correction was received from the GPS base station. ***Note*** *– Can also be viewed from the Run screen.*
Correction Type	Solution type (for example: RTK Fixed, or RTK Float, etc.) ***Note*** *– Can also be viewed from the Run screen.*
Cut/fill	Difference between the blade height and the target height. When Cut is displayed, the current ground height is above the target height, and the height adjustment indicator shows a red down arrow, which means that the blade needs to moved down to reach the target height. When Fill is displayed, the current ground height is below the target height.
Design Height	Originally planned or designed height at the current location.
Design Slope	Design slope with respect to the current location along the section line. Used with Autoslope leveling model.
Distance Traveled	Distance traveled since Auto mode was enabled. Used with Point to Slope leveling model.
East	Difference in the East component from the Local Tangent Plane (LTP).
GPS Status	Solution type (for example: RTK Fixed, or RTK Float, and so on). ***Note*** *– Can also be viewed from the Run screen.*
H Error	Current estimate of the error in the horizontal component.
HDOP	Horizontal dilution of position. Horizontal component of PDOP.
Heading	Current direction the vehicle is heading in
Latitude	Latitude as recorded by the GPS receiver

Status Item	Explanation
Longitude	Longitude as recorded by the GPS receiver.
Network ID	Network ID of the GPS receiver, which must be the same as the base receiver network ID.
North	Difference in the North component from the Local Tangent Plane (LTP).
Offset	Relative offset in the vertical component.
Offset X	Relative offset in the X axis.
Offset Y	Relative offset in the Y axis.
Satellites	Amount of satellites in the GPS/GLONASS solution.
Section Line Number	Line number selected for design in AutoSlope. This is the current section line being recorded in the field.
Speed	Current speed of the vehicle.
Survey Cut / Fill	Cut/fill for the location of the vehicle within a field that has been processed in AutoPlane.
Target Height	Height the blade will attempt to reach. This is the design height ± the offset. When the blade reaches the target height, the arrows turn green.
Up	Difference in the up component from the Local Tangent Plane (LTP).
VDOP	Vertical dilution of precision. Vertical component of PDOP.
Vertical Error Estimate	Current estimate of error in the height calculated by the FieldLevel GPS receiver.

Dual scraper controls



Blade height indicators:

- The left height indicator shows the height of the left/primary blade.
- The right height indicator shows the height of the right/secondary blade.

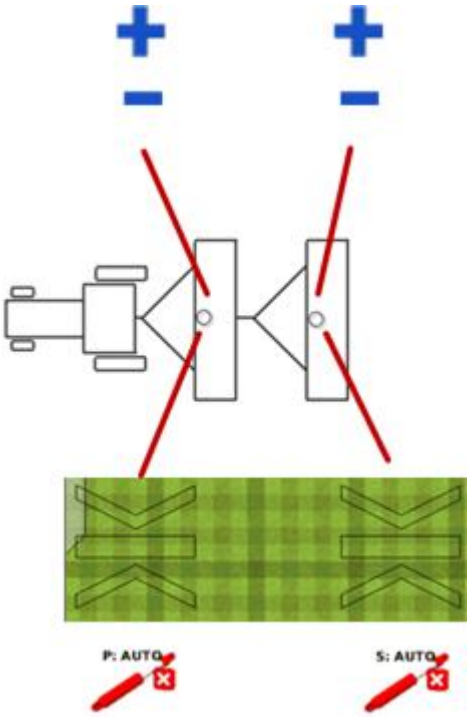
Left plus and minus: Controls the blade height for the left/primary blade.

Right plus and minus: Controls the blade height for the right/secondary blade.

: Controls the left/primary automatics

: Controls the right/secondary automatics

Tandem scraper controls



Left plus and minus: Controls the blade height for the front/primary blade.

Right plus and minus: Controls the blade height for the rear/secondary blade.

Blade height indicators:

- The left height indicator shows the height of the front/primary blade.
- The right height indicator shows the height of the rear/secondary blade.

: Controls the front/primary automatics

: Controls the rear/secondary automatics

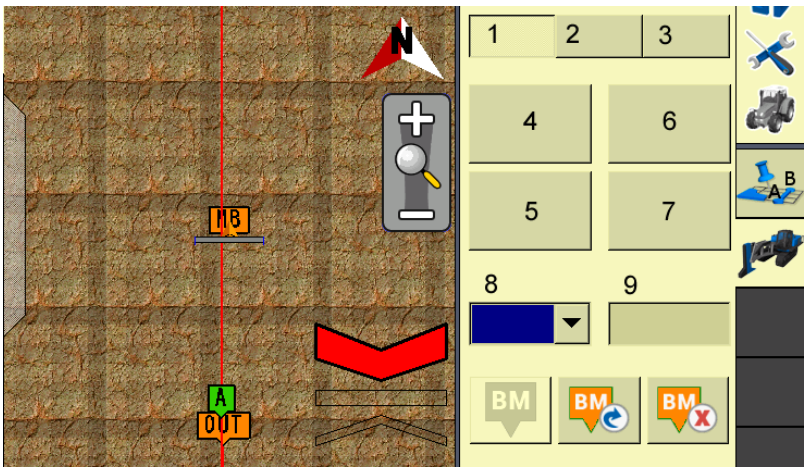
WM-Drain operation

To use WM-Drain, you:

- Create a tile / ditch survey line (page 412)
- Set survey height offset (page 412)
- Design a section line (page 419)
- Installation/ditch cleaning (page 423)

Survey tab

The Survey tab is used to create a survey by creating a master benchmark and logging survey points while driving the area you want to survey.



Item	Explanation
1	Survey tab
2	Design tab (page 414)
3	Install tab (page 423)
4	**Record Section** button
5	**Pause Section** button
6	**Delete Section** button
7	**Manual Data Point** button
8	Type of design: Main
9	Size of design
	Create Benchmark: Tap to create a benchmark
	Rebench: Tap to rebench
	Delete Benchmark: Delete a benchmark

Create a tile / ditch survey line

Before creating the survey line, Set survey height offset (page 412). This offset will be applied to the heights of your surveyed alignment so that you do not need to rebench before installing tile.

1. At the *Run* screen, tap to open the WM-Drain panel.
2. Go to the Survey tab of the panel.
3. Drive to a point that will be untouched to use as a reference point.
4. Tap to create a master benchmark and flag this point so you can find it again easily.
5. Drive the vehicle to the start of the line where you want to install tile or clean a ditch.

   Note *– For the most efficient method, it is recommended that you drive to the high end of the line.*
6. From the Type list, select the type of design. The options are Main, Sub main and Lateral.
7. In the Size entry box, enter the size of the design.
8. Tap **Record Section** to begin recording a section and then drive. To pause recording, tap **Pause Section**. (The **Record** button changes to white when activated.)

   If you have created a section you want to remove, tap **Delete Section** and choose the section from the list that displays.

   Note *– For the most efficient method, it is recommended that the end point is where the tile line is to be connected to a main or outlet.*
9. To add a manual survey point at a distance different from the normal survey distance, tap **Manual Data Point**.
10. Tap **Record** again to stop the recording.
11. If you create a benchmark you want to remove, tap and choose the benchmark from the list that displays.

Set survey height offset

To set the Survey Height Offset:

1. At the *Home* screen, tap . The *Configuration* screen displays.
2. Select WM-Drain and tap **Setup**.
3. On the tile plow, raise the boot as high as it will raise.
4. Measure the distance from the bottom of the tile boot to the ground.
5. Enter this value into the Survey Height Offset entry box.

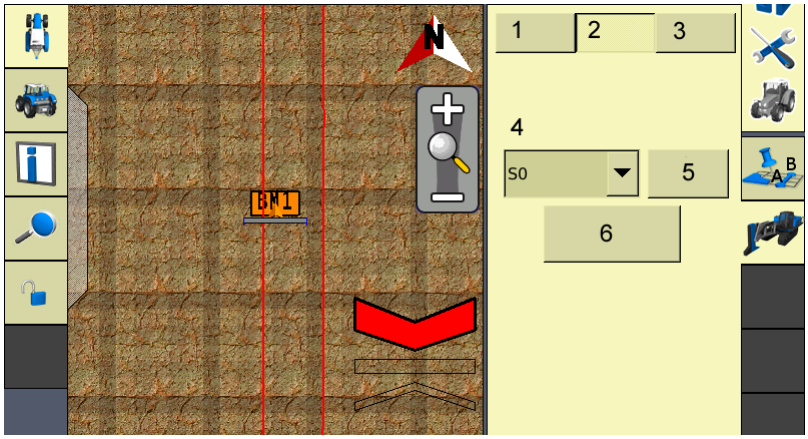
   Note *– It is recommended that you change the survey point spacing to 1.5m (5 feet). This will then*

record the survey points every 1.5M (5 feet) and provide a more accurate profile of the ground surface.

6. Tap **OK**.

Design tab

On the Design tab, you choose a section to design and tap **Design**. The Design screen (page 415) opens.

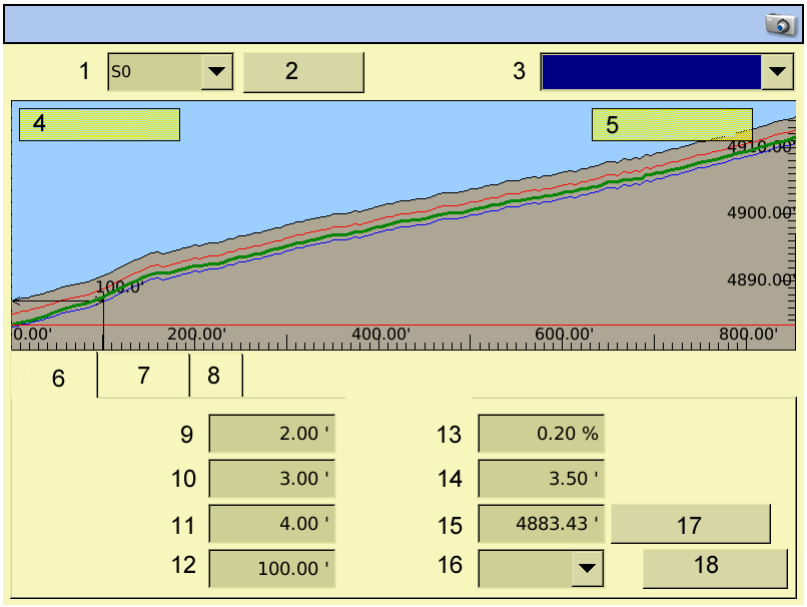


Item	Explanation
1	Survey tab (page 411)
2	Design tab
3	Install tab (page 423)
4	Section: Section chosen to design
5	**Select Closest** button: Tap to choose the closest section
6	**Design** button: Tap to open the Design screen (page 415)

Design screen

At the Design screen, you determine the design of the section line you have chosen.

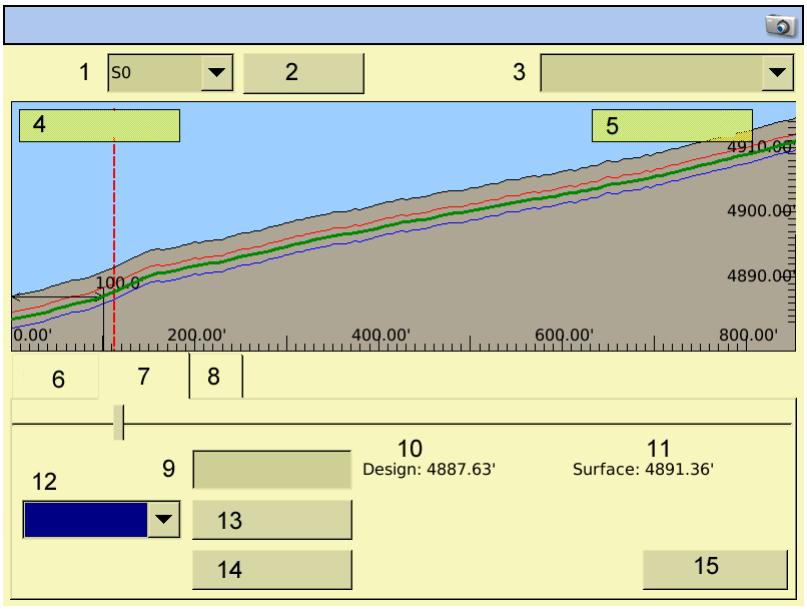
Settings Tab



Item	Explanation
1	Section: The section you are currently designing.
2	**Rename** button: Tap to rename the section.
3	Direction list: The design screen shows the outlet at the left side of the screen and runs the design uphill to the right side of the screen. The direction of the profile is defined by the direction that it was surveyed. If your survey profile is displayed the other way, switch the option shown in the Direction list to the other option in the list. Options are: • Outlet at Survey Start • Outlet at Survey End
4	Outlet information: Elevation of outlet depth.
5	Boot Slope information: The current reading for the boot slope from the IMD-600.
6	Settings tab

Item	Explanation
7	Edit Line tab
8	Info tab
9	Minimum Depth: The minimum depth for the tile or ditch installation. The system will not allow the design profile to be any shallower than the minimum depth, which is shown on the profile as a red line. ***Note*** *– For ditching applications, this depth is set close to the surface*
10	Optimal Depth: The depth to install the tile or ditch. The design will keep this to the depth when it can. It will move off the optimal depth to be within the other constraints where it is needed. ***Note*** *– For ditching applications, this depth is set close to the surface.*
11	Maximum Depth: The maximum depth for the tile or ditch installation. The system will not allow the design profile to be any deeper than the maximum depth, which is shown on the profile as a blue line.
12	Outlet to Optimal: The distance it takes to change the depth of the design from the Outlet Depth to the Optimal Depth. The tile plow will level out over a long distance rather than trying to achieve the depth too quickly at the start of a run.
13	Minimum Slope: The minimum slope for the tile or ditch installation. The system will not allow the design to slope to be any less than the minimum slope.
14	Outlet Depth: The depth at which the design profile will be at the outlet. This depth can either be entered or measured. To measure the depth: 1. Drop the tile plow into the ground so the boot is at the same height as the main or outlet. 2. Tap Measure. The outlet depth is entered by the system. Also, another point is added to the section line if you are within 20 m (65 ft) of the end of the surveyed section line. The height of the outlet is shown by a yellow tag.
15	Outlet Elevation: The real or relative elevation of the outlet.
16	Smoothing list: The required smoothing level (None, Low, Medium, High) to work out any humping sections in the design. It is recommended you use either Low or Medium smoothing.
17	**Measure Outlet** button: Tap to show the outlet depth and outlet elevation layers with the current boot depth in relation to the surveyed surface.
18	**OK** button: Tap to save any changes to the design.

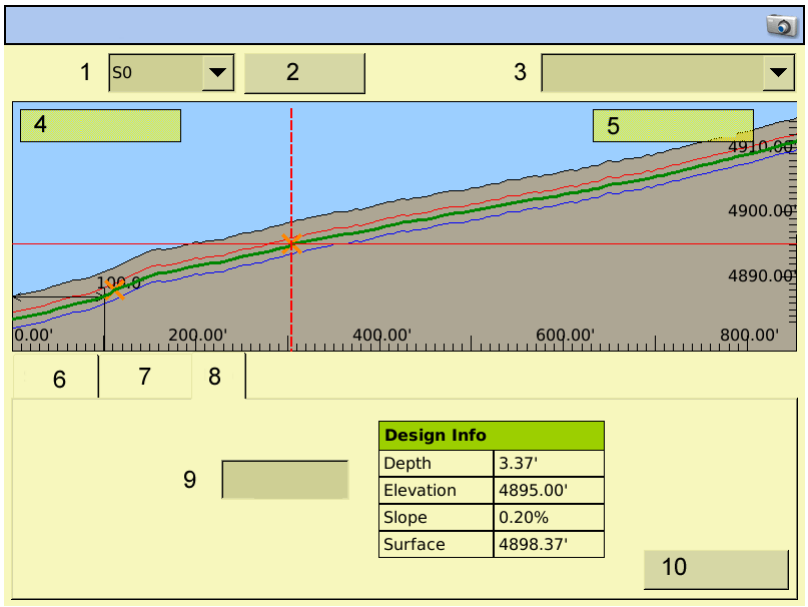
Edit Line tab



Item	Explanation
1	Section: The section you are currently designing.
2	**Rename** button: Tap to rename the section.
3	Direction list: The design screen shows the outlet at the left side of the screen and runs the design uphill to the right side of the screen. The direction of the profile is defined by the direction that it was surveyed. If your survey profile is displayed the other way, switch the option shown in the Direction list to the other option in the list. Options are: • Outlet at Survey Start • Outlet at Survey End
4	Outlet information: Elevation of outlet depth.
5	Boot Slope information: The current reading for the boot slope from the IMD-600.
6	Settings tab
7	Edit Line tab
8	Info tab
9	Distance: The distance of the fixed point from the beginning of the line.

Item	Explanation
	Clipping Distance: The distance from the beginning of the line.
10	Design information: Elevation of the designed section at that location.
11	Surface information: Elevation of the surface at that location.
12	Design Tool list: Options: Clip Start, Clip End, Fix Point.
13	**Add** button: Tap to add a fixed point to the design. **Clip** button: Tap to clip the designated portion of the section line.
14	**Delete All** button: Tap to delete all of the fixed points created.
15	**OK** button: Tap to save any changes to the design.

Info tab



Item	Explanation
1	Section: The section you are currently designing.
2	**Rename** button: Tap to rename the section.
3	Direction list: The design screen shows the outlet at the left side of the screen and runs the design uphill to the right side of the screen. The direction of the profile is defined by the direction that it was surveyed. If your survey profile is displayed the other way, switch the option shown in the Direction list to the other option in the list.

Item	Explanation
	Options are: • Outlet at Survey Start • Outlet at Survey End
4	Outlet information: Elevation of outlet depth.
5	Boot Slope information: The current reading for the boot slope from the IMD-600.
6	Settings tab
7	Edit Line tab
8	Info tab
9	Distance: The selected location's distance from the start of the section line.
10	**OK** button: Tap to save any changes to the design.

Design a section line

After you create survey lines, use design screen to create designs for installing tile or cleaning ditches along those lines.

1. At the *Run* screen, tap to open the WM-Drain panel.
2. Go to the Design tab of the panel.
3. From the Section list, select the section line that you want to design and tap **Edit Design**.
4. If required, tap **Select Closest**. This enables you to select the line that is closest to you. If there is more than one line within 10 m of your current position, the *Select Closest Section Line* screen displays. The line that is calculated as being closest to you is highlighted. The section line number and pipe type are shown. Choose the line you want and tap **OK**. The system displays the *Design* screen.
5. At the *Design* screen, from the Section list choose the section line you want to design.

Setting at Top of Screen	Explanation
Section Selection	Auto: The nearest section line is automatically selected. Manual: Manually select a section from the list.
Rename button	Tap to rename the section name.
Direction	The design screen shows the outlet at the left side of the screen and

Setting at Top of Screen	Explanation
	runs the design uphill to the right side of the screen. The direction of the profile is defined by the direction that it was surveyed. If your survey profile is displayed the other way, switch the option shown in the Direction list to the other option in the list. Options are: • Outlet at Survey Start • Outlet at Survey End

Note *– The section lines are labeled automatically by the system (beginning at S1) in the sequence they were surveyed.*

6. Edit the design to your requirements.

   On the Settingstab, set:

Settings Tab	Explanation
Min Depth	The minimum depth for the tile or ditch installation. The system will not allow the design profile to be any shallower than the minimum depth, which is shown on the profile as a red line. ***Note*** *– For ditching applications, this depth is set close to the surface.*
Optimal Depth	The depth to install the tile or ditch. The design will keep this to the depth where it can. It will move off the optimal depth to be within the other constraints where it is needed. ***Note*** *– For ditching applications, this depth is set close to the surface.*
Max Depth	The maximum depth for the tile or ditch installation. The system will not allow the design profile to be any deeper than the maximum depth (shown as a blue line).
Outlet to Optimal	The distance it takes to change the depth of the design from the Outlet Depth to the Optimal Depth. The tile plow will level out over a long distance rather than trying to achieve the depth too quickly at the start of a run.
Min Slope	The minimum slope for the tile or ditch installation. The system will not allow the design to slope to be any less than the minimum slope.
Outlet Depth	The depth at which the design profile will be at the outlet. This depth can either be entered or measured. To measure the depth: a. Drop the tile plow into the ground so the boot is at the same height as the main or outlet.

Settings Tab	Explanation
	b. Tap **Measure**. The outlet depth is entered by the system. Also, another point is added to the section line if you are within 20 m (65 ft) of the end of the surveyed section line. The height of the outlet is shown by a yellow tag.
Outlet Elevation	Elevation of outlet depth.
Smoothing	The required smoothing level (None, Low, Medium, High) to work out any humping sections in the design. It is recommended you use either Low or Medium smoothing.
Measure Output button	Tap to show the outlet depth and outlet elevation layers with the current boot depth in relation to the surveyed surface.
Distance	Tap the design graph or enter a distance to display the Design Info (depth, elevation, slope, surface) for that location.

7. On the Edit Line tab, you have the options to:
   a. Indicate fixed points on the line. See Add a fixed point (page 422).
   b. Clip and remove sections of the line. See Clip a portion of a section line (page 421).
8. Tap **OK**.

At the *Run* screen, you can install the tile or clean the ditch from either the outlet or the top end of the profile. The section line that you use for installation or cleaning will display as red on the screen (other section lines are white).

Clip a portion of a section line

You can remove a portion of the section line from either the beginning or end of the line (or both).

1. At the Design tab, tap **Design** to open the *Design* screen.
2. Go to the Edit Line tab.
3. From the far left-hand list at the bottom of the screen, choose either Clip Start or Clip End (depending on which end of the line you want to remove).
4. Indicate where you want to clip to by:
   a. Touching on the screen
   b. Moving the slider
   c. Entering a specific distance in the Distance entry box
5. When you have finished indicating the areas to clip, tap **Delete All**.
6. To save the changes, tap **OK**.

Add a fixed point

You can add a fixed point to your design. This enables you to avoid:

- An underground structure
- Intersecting a specific depth or existing tile line

1. At the Design tab, tap Design to open the *Design* screen.
2. Go to the Edit Line tab.
3. From the far left-hand list at the bottom of the screen, choose Fix Point.
4. Indicate where you want the fixed point by:
   a. Touching on the screen
   b. Moving the slider
   c. Entering a specific distance in the Distance entry box
5. Tap **Add**. The screen will show the design elevation for the fixed point.
6. Enter the elevation that represents the target or obstacle. The system redesigns the section line to account for the new fixed point. If the slope approaching the point is now too steep, you have the option to enter more fixed points ahead of the original fixed point to make the transition better from one slope to the next.

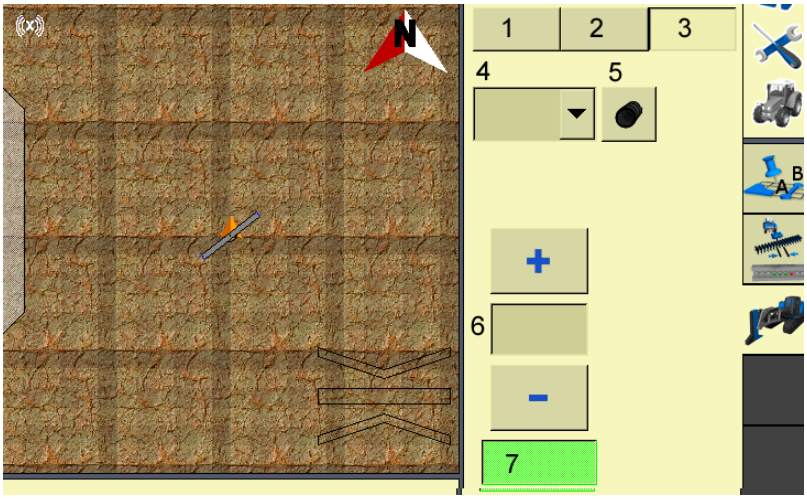
Define boot depth

You can define the boot depth by either of the steps below.

- Option 1: Enter the relative depth above and below the surveyed surface.
- Option 2: Enter a specific elevation in the Outlet Elevation box. The system calculates the other box.

Install tab

On the Install tab, you perform installation.



Item	Explanation
1	Survey tab (page 411)
2	Design tab (page 414)
3	Install tab
4	Mode:
5	Type of pipe: The type of pipe to install. Options are: Main, Sub-Main, Lateral
6	Height Offset controls ▬ - Decrease height offset ✚ - Increase height offset
7	Choice of Coarse or Fine increments for changing height offset

Installation/ditch cleaning

Autoslope mode

You can use the Autoslope mode for:

- For tile applications: The system runs on both self-propelled tile machines and pull-type plows towed behind a tractor.
- For ditching applications: You can use any type of scraper or ditching machine supported by the WM-Drain system.

Note *– When the system is not running in Autoslope mode, the on-screen or LB25 lightbar will guide to any existing A-B line. This means you can use manual guidance for surveying in section lines to be tiled at a consistent spacing.*

1. At the *Run* screen, tap to open the WM-Drain panel.
2. Go to the Install tab of the panel. Use the controls for installation or ditch cleaning.

Control	Explanation
Survey	Tap to open the *Survey* screen where you can survey the section line you will design.
Design	Tap to open the *Design* screen where you can select a section line and then edit the design. ***Note*** *– A white cross displays on the Run screen to show both the horizontal and vertical location.*
Mode	• Autoslope: Creates sloped tile or surface drainage targeting the optimal depth defined on the Design tab. • Slope: Creates consistently sloped tile or surface drainage. From the starting point, the vehicle leves at a constant slope, regardless of direction. • Constant Depth: Use to collect a live, rolling survey of the ground surface. This survey is passed in real time to the control system, which enables it to run at the specified depth above or below the ground surface. The constant depth mode can only be accessed when you have properly configured manual guidance, Autopilot or EZ-Pilot. This mode requires two RTK-enabled receivers are available and assigned on the system. One of the RTK-enabled receivers: • Is not required to be an internal receiver • Must be assigned to the appropriate guidance plugin/feature • Must be mounted in front of the antenna used for WM-Drain
Pipe	Pipe Type: Select the type of pipe to be installed. Pipe Size: The size of the pipe to be installed.
Recalc	When the tile plow encounters a rock, pull the boot up over the rock and tap **Recalc**. This modifies the design to ensure the remaining tile run stays within the minimum slope requirement and prevents the pipe from diving

Control	Explanation
	down to the original design grade. ***Note*** *– This works only when installing tile in the direction away from the outlet point.*
Height Offset Increase button	Raise the tile boot or blade by the blade step increment.
Height Offset Decrease button	Lower the tile boot or blade by the blade step increment.
Height Offset **Coarse** or **Fine** button	When you tap **Coarse**, the increase or decrease button moves the blade by the Coarse Blade increment. This enables you to move the blade by a larger increment. When you tap **Fine**, the increase or decrease button moves the blade by the fine increment.
Pitch Offset Increase	Raises the blade pitch relative to the design pitch.
Pitch Offset Decrease	Lowers the blade pitch relative to the design pitch.
Coarse (Pitch Offset)	When you tap Coarse, the increase or decrease button moves the blade by the Coarse Pitch increment. This enables you to move the blade pitch by a larger increment.

Point and slope mode

1. At the *Run* screen, tap to open the WM-Drain panel.
2. Go to the Install tab of the panel. Use the controls for installation or ditch cleaning.

Control	Explanation
Survey	Tap to open the *Survey* screen where you can survey the section line you will design.
Design	Tap to open the *Design* screen where you can select a section line and then edit the design. ***Note*** *– A white cross displays on the Run screen to show both the horizontal and vertical location.*
Mode	• Autoslope: Creates sloped tile or surface drainage targeting the optimal depth defined on the Design tab.

Control	Explanation

	• Slope: Creates consistently sloped tile or surface drainage. From the starting point, the vehicle leves at a constant slope, regardless of direction.
	• Constant Depth: Use to collect a live, rolling survey of the ground surface. This survey is passed in real time to the control system, which enables it to run at the specified depth above or below the ground surface.
	The constant depth mode can only be accessed when you have properly configured manual guidance, Autopilot or EZ-Pilot.
	Run depth is defined by setting the Height Offset value to the desired depth. Examples:
	  • For a consistent depth of 4.0' (1.22 m), adjust the Height Offset to -4.0' (-1.22m).
	  • For a consistent height of 6" (0.15 m) above the ground surface, adjust the Height Offset to 6" (0.15cm).
	This mode requires two RTK-enabled receivers are available and assigned on the system. One of the RTK-enabled receivers:
	  • Is not required to be an internal receiver
	  • Must be assigned to the appropriate guidance plugin/feature
	  • Must be mounted in front of the antenna used for WM-Drain

Pipe	• Pipe Type: Select the type of pipe to be installed. • Pipe Size: The size of the pipe to be installed.
Slope Increase	Increase the design slope by the Slope Adjust increment.
Slope Decrease	Decrease the design slope by the Slope Adjust increment.
Height Offset Increase	Raise the tile boot or blade by the Slope Adjust increment.
Height Offset Decrease	Lower the tile boot or blade by the Slope Adjust increment.
Height Offset Increase	Raise the boot or blade by the blade step increment.
Height Offset Decrease	Lower the boot or blade by the blade step increment.
Slope	Select a defined percentage of vertical drop for a horizontal distance

Control	Explanation
	traveled.
Coarse (Height Offset)	When you tap **Coarse**, the increase or decrease button moves the blade by the **Coarse Blade** increment. This enables you to move the blade by a larger increment.
Pitch Offset Increase	Raises the blade pitch relative to the design pitch.
Pitch Offset Decrease	Lowers the blade pitch relative to the design pitch.
Coarse (Pitch Offset)	When you tap **Coarse**, the increase or decrease button moves the blade by the Coarse Pitch increment. This enables you to move the blade pitch by a larger increment.
Auto	Set Automatics to the hydraulic valve. The blade or tile boot will be driven to the design depth depending on where you are located relative to the section line.
Logging	Tap to log coverage to be able to see on your map where you have been dependent on your implement width. A shape file will also be created with cut/fill and height information.

Yield Monitoring operation

Yield Monitoring enables you to track the:

- Loads of grains harvested through the season for a field.

  After the harvest is complete, use the Farm Works™ Mapping software to track loads in the office. See Load tracking (page 430).

- Variety of grains harvested throughout the season for a field that has an associated planting variety map.

  After harvest is complete, use the Farm Works Mapping software to create and view a yield variety report to see a yield by variety comparison. See Variety tracking (page 429).

Yield Monitoring panel

To access the Yield Monitoring panel, at the *Run* screen tap .

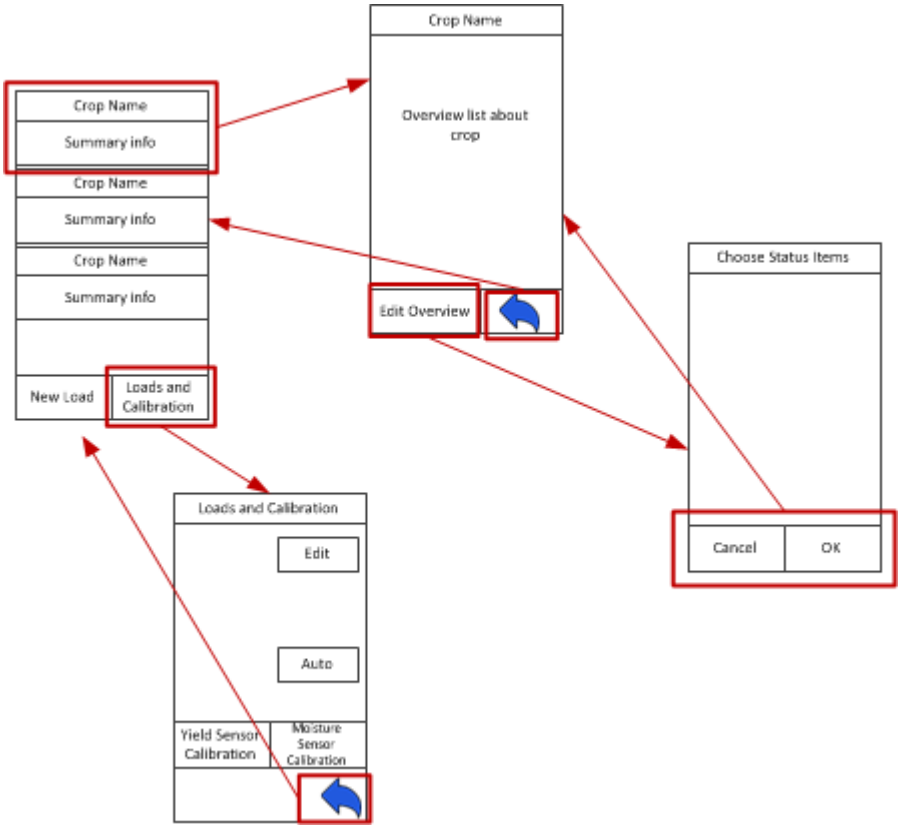
The panel contains several views that you can navigate between.

Crop summary and details

The initial view shows each crop being harvested and summary information for each one.

Tap a crop/summary section to see more details about the crop.

To change the status items that show for a crop, at the Crop Name view tap **Edit Overview**.



Variety tracking

For a field that has an associated planting variety map, Yield Monitoring enables you to track the variety of grains harvested throughout the season.

Variety map

When you are planting or seeding and are using version 6.0 or later of the FM-1000 integrated display, a variety map layer is created within the Field folder if you are using either:

- Field-IQ crop input control system
- Serial Rate Control

When you open the client, farm, and field and create a harvest event, the system automatically loads the variety map layer into the background on the screen.

Note *– Set up the implement as a harvest operation if you want the variety map layer to display.*

After harvest is complete, use the Farm Works Mapping software to create and view a yield variety report to see a yield by variety comparison.

Load tracking

Yield Monitoring tracks loads of grains harvested through the season for a field. After the harvest is complete, use the Farm Works™ Mapping software to track loads in the office.

At the *Load Details* screen, you can view for each load listed:

Item	Explanation
Load Name	Name you assigned to the load
Recorded Weight	The weight of the load
Scale Ticket Weight	
Recorded Moisture	
Scale Ticket Moisture	

CHAPTER 19

Diagnostics

In this chapter:

System diagnostics **432**
Autopilot diagnostics **434**
EZ-Pilot diagnostics **436**
EZ-Steer diagnostics **437**
Field-IQ diagnostics **438**
FieldLevel II diagnostics valve test **460**
GPS status **460**
GreenSeeker diagnostics **460**
Row-Guidance diagnostics **461**
Vehicle Sync diagnostics **463**
Yield Monitoring diagnostics **464**

This chapter covers diagnostics and troubleshooting.

System diagnostics

At the *Configuration* screen, select System and then tap **Diagnostics**. Each tab contains specific information about the system:

- Advanced system diagnostics (page 432)
- CAN Bus data (page 433)
- Network diagnostics (page 433)
- Serial Comms (page 433)

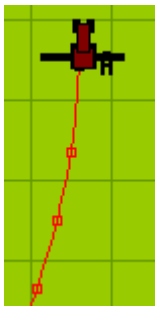
Advanced system diagnostics

1. At the *Configuration* screen, tap System and then tap **Diagnostics**.
2. Go to the **Advanced** tab.
3. Select the Diagnostics Level. This determines how much debugging information is logged in the program files.

Item	Explanation
1	Minimal level of information
6 (default)	Medium level of information
9	Highest level of information

4. At Swath Control Points, select whether to hide or show swath control points.

   When the guidance line is a curve, it displays on-screen as a series of short straight sections joined together. Swath control points appear where these line segments meet.



You can also use the *System Diagnostics* screen to view raw port data. For more information, see Serial Comms (page 433).

CAN Bus data

You can view CAN Bus data as the display receives it.

To view the data:

1. At the *Configuration* screen, select System and then tap **Diagnostics**.
2. Go to the CAN Bus tab.
3. To view the data from a port, tap **View**. The port diagnostics screen for that port displays.
4. To capture data, tap the **Capture** button. Approximately five seconds of serial data is captured and then displays on the screen. You can review the data or capture another snapshot of data.
5. To close the screen, tap **OK**.

Configuration data

1. To view display configuration information, tap .
2. The *Home* screen shows:
   - Display firmware information
   - Autopilot controller information
   - GPS receiver and correction method information
   - Vehicle make and model

Network diagnostics

1. At the *Configuration* screen, tap System and then tap **Diagnostics**.
2. Go to the **Network** tab.

The status of various network connections display.

To enable Remote Assistant, select Enabled.

Serial Comms

You can view raw serial data as the display receives it. This can be useful for analyzing the GPS signal.

To view the raw serial data:

1. At the *Configuration* screen, select System and then tap **Diagnostics**.
2. Go to the Serial Comms tab. This diagnostics screen shows each of the connectors (ports) on the display harness and the number of data packets that have been sent and received.
3. To view the raw data from a port, tap **View**.
4. To capture data, tap **Capture**. Approximately five seconds of serial data is captured and then displays on the screen. You can review the data or capture another snapshot of data.
5. To close the screen, tap **OK**.

Note *– Text shown in green is incoming data. Text shown in red is outgoing data.*

Autopilot diagnostics

1. At the *Configuration* screen, select Autopilot.
2. Tap **Diagnostics**. The *Vehicle Controller Setup - Guidance* screen displays. From this screen, you can access information on:
   - Guidance
   - Steering
   - Details
   - Fault log
   - Warnings

Controls

The following buttons are available on every tab:

- **Engage**: You can tap to engages or disengage the system. The button also shows the current engage state. When this button is red, tap it to see the fault that is preventing the automatic mode.
- **View Fault Log**: Tap to view faults.
- **View Warning**: Tap to view warnings.

Guidance tab

Section	Explanation
Offline distance graph	A graph of offline distance over time. Useful for diagnosing problems with the vehicle coming online and staying online.
GPS status	Current GPS position fix quality and number of satellites
Heading error	The difference between vehicle heading and path heading
Roll	Current roll value calculated by the system
Direction	Current vehicle direction: Forward, backward, or stopped
Cross Track Error	Numeric value of the offline distance
On-screen lightbar	Visual representation of offline distance
Heading	Current vehicle heading calculated by the system
Speed	Current vehicle speed calculated by the system
1PPS	Shows whether the 1PPS signal from a GPS receiver is detected
Aggressiveness	A slider to adjust the aggressiveness of the steering system.
Nudge	Enter the increment of distance you want for nudging.

Steering tab

Section	Explanation
PWM status	Shows the current PWM signals being sent to the electro-hydraulic valve. This is an indication of whether the system is attempting to turn left or right.
Steering command override	Bypasses the normal steering command to the wheels. With this feature, you can force a certain angle of turn and make sure that the system responds as expected.
Steering angle	Required angle: The angle that the system is trying to attain Steering angle: Where the system calculates the wheels are pointing
Enable	
Reset	

Details tab

Section	Explanation
Diagnostics	Vehicle and configuration specific diagnostics. Up to nine diagnostics can be shown.
Accelerometers	Raw voltage and scaled G-force for each of the system's accelerometers
Vehicle voltage	Input voltage currently being fed into the Autopilot system from the vehicle's electrical system
Vehicle voltage	Input voltage currently being fed into the Autopilot system from the vehicle's electrical system

Autopilot Faults screen

The *Autopilot Faults* screen lists all faults on the Autopilot controller. To access this screen tap **View Fault Log**.

Item	Explanation
Active	Faults that are currently active
History	Faults that have previously occurred
Cancel	Tap to close the screen.
Refresh Fault Lists	Tap to see the latest faults.
Clear History	Tap to clear historical faults.
Close & Clear Faults	Tap to clear all faults and close the screen.

Warning screen

When you are viewing the vehicle diagnostics screens, the **View Warning** button flashes red if there is an active warning. To view any active warnings, tap the button.

EZ-Pilot diagnostics

The *EZ-Pilot Diagnostics* screen contains the statistics for the IMD-600 and SAM-200 and inertial information.

1. At the *Home* screen, tap .
2. At the *Configuration* screen, tap EZ-Pilot and then tap **Diagnostics**.
   The *EZ-Pilot Diagnostics* screen displays.

IMD-600 status	Explanation
Status	Status of the system's connection to the IMD-600
Version	Firmware version of the IMD-600
Serial Number	Serial number of the IMD-600

SAM-200 status	Explanation
Status	Status of the system's connection to the SAM-200
Version	Firmware version of the SAM-200
Serial Number	Serial number of the SAM-600
Temperature	Temperature of the SAM-600
Voltage	

3. To view faults, tap **View Fault Log**.
4. To adjust the steering performance of the system, tap **Steering Performance**. See EZ-Pilot system calibration (page 169).

EZ-Steer diagnostics

1. At the *Home* screen, tap .
2. At the *Configuration* screen, tap EZ-Steer and then tap **Diagnostics**. The *EZ-Steer Diagnostics* screen displays the SCM statistics and inertial information.
3. To view faults, tap **View Fault Log**.
4. To adjust the steering performance of the system, tap **Steering Perf**. See EZ-Steer system calibration (page 174).

Field-IQ diagnostics

1. At the *Home* screen, tap .
2. At the *Configuration* screen, tap Field-IQ and then tap **Diagnostics**. The *Field-IQ Diagnostics* screen displays.

Operations tab

On this tab, you can:

- Test optional switch box (page 354) if you are using an optional section switch box
- Enter values manually (page 354)
- Enable sections (page 353)

Status Item	Explanation
Control Mode	Auto or Manual
Rate Switch Mode	Manual, Rate 1 or Rate 2
Applied Rate	The rate being applied
Current Flow	Relation of material being applied to time
Control Speed	Speed you are moving
Master Switch	Indicates which switches have been assigned to each section.

Tap **View Error Log** to see all errors listed since the last time the log was cleared.

Tap **Section Test** to begin a sequence of engaging each section and groups of sections.

The color coding for the sections are:

Section Number Tab	Section Indicator Graphic	Section is...	Section switch is...
Not indented	Red	Not armed	Off
Not indented	Gray	Not armed	On
Indented	Red	Armed	Off
Indented	Green	Armed	On

Testing section switches

Testing the switches from the Diagnostic screen is useful because you do not have to open a field or set a manual speed and manual coverage to make the section switches active.

At the Operation tab:

1. Arm the sections by tapping on the box with the sections you want to turn on.
2. Flip the section switches to test that they are working properly and are in the correct order.

Hardware tab

On this tab, the control modules are listed with the:

- Serial number of the module
- Position on the implement
- Firmware version
- Status of CAN connection
- Tx/Rx number of packets

Row Monitor tab

The status column of this screen indicates:

- Disabled: Sensor is not detected.
- Off: Sensor is detected but is not actively looking for seed.
- On: Sensor is detected and is looking for seed. (The field is open with system planting.)

Field-IQ faults and troubleshooting

Faults

Message That Displays	Explanation	Possible Causes/Actions
Field-IQ devices not found.	One or more Field-IQ system devices in the current implement configuration are not present.	Check: • Implement selection • Cabling and fuses • Field-IQ Diagnostics to identify missing modules • Field-IQ Setup
New Field-IQ devices need configuring. Please go to the Field-IQ Setup.	The Field-IQ system cannot be used without the master switch box.	Check: • Cabling • To see if CAN has been dropped. Check terminators.
The 12-section switch box has been disconnected. Sections will be controlled automatically.	Field-IQ can operate without the 12-section switch box. Section switching will depend only on existing coverage, field boundaries and exclusion zones. To get on-screen buttons for controlling sections, cycle power to the display.	Check: • Cabling • To see if CAN has been dropped. Check terminators.
One or more Field-IQ system devices were disconnected.	One or more Field-IQ system devices have lost communication with the system.	Check: 1. Cabling and fuses 2. Field-IQ system Diagnostics to identify missing modules 3. Field-IQ System Setup
Rate not achievable For current target rate, the maximum speed is X mph.	The target application rate cannot be achieved within the configured maximum RPM at the current speed. The Field-IQ system is limiting the RPM to the configured maximum.	Maximum flow/rpm has been set too low for desired speed and rate.

Message That Displays	Explanation	Possible Causes/Actions
Target rate may not be achieved for current target rate, the minimum speed is X\ mph.	At the current speed and target application rate, the required RPM is below the configured minimum RPM limit.	Minimum flow/rpm has been set to high for desired speed and rate.
The current coverage pattern will degrade system performance.	A "combing" coverage pattern is being generated because of a mix of on and off boom sections. This causes generation of many coverage polygons, possibly leading to degraded system performance.	Contact Trimble support.
Hydraulic motor over speed. or Hydraulic motor under speed	The hydraulic motor is not running at the commanded speed.	
Rate control stopped due to hydraulic motor over speed or Rate control stopped due to hydraulic motor under speed	The hydraulic motor was stopped due to it not running at commanded speed.	
Hydraulic motor stalled Rate control has been disabled. Toggle the master switch to re-enable rate control.		No RPM is being reported from encoder.
Check the hydraulic motor. It ran too fast (Rawson).	The hydraulic motor is not running at the commanded speed	Check hydraulic pressure.
Degraded GPS. Automatic section control has been disabled. Use switches to control sections.	The GPS positions are uncorrected. Due to potential inaccuracy of the positions, the Field-IQ system will not switch the boom sections automatically. You must control the sections manually through	

Message That Displays	Explanation	Possible Causes/Actions
	the switches.	
No GPS. Automatic rate and section control has been disabled. Please maintain speed at X mph.	The Field-IQ system is no longer adjusting the application rate. You are prompted to maintain the current speed. The last sentence appears only if the master switch was on at the time of the warning.	
Tank/bin level is getting low.	General system warning	
Using jump start speed. Please maintain speed at XX mph.	The GPS speed has been overridden with the jump start speed. You must drive at that speed to maintain the current target application rate.	
A power brown-out has occurred - check cabling and fuses - check power supply	Warning typically appears when system drops under 10 V.	Check: • Cabling and fuses • Power supply
Section controller reported over-current. Section and rate control have been disabled. Toggle the master switch to re-enable control.		Possible causes: Controller is drawing too much current. There is an electrical short somewhere.
Rate and Section Control Module Not Configured Please set the number of nozzles in the Field-IQ Setup	Number of nozzles has not been set.	
Controller Requires Valve Calibration		Go to the Valve Calibration screen to set the valve type.
Sprayer configuration error Check the settings on the Valve Calibration screen	The valve type, plumbing, or auxiliary valve setting is incorrect.	
Flow meter configuration error	The flow meter calibration number has not been set.	

Message That Displays	Explanation	Possible Causes/Actions
Check the flow meter calibration		
Shaft encoder configuration error Check the Shaft Encoder Constant in the Flow Calibration screen	The shaft encoder constant has not been set.	
Valve configuration error Check the valve calibration	The valve settings are not valid for the selected valve type.	
Unknown Field-IQ configuration error	This message shows if the FM-1000 integrated display does not understand the fault code that was received from the rate and section control module.	Check firmware versions. Report this fault to Trimble Support.
No flow detected	The Field-IQ system attempted to apply material, but the flow sensor failed to detect any flow.	Possible causes: • Incorrect flow calibration • Damaged or disconnected feedback sensor • Broken valve wiring
Attention Minimum flow XX gal/min is applying	The current target application rate and speed require a flow that is less than the configured minimum flow limit. The flow will be at that limit instead. Therefore, the actual applied rate will probably be above the target rate.	
Rate not responding.	The flow sensor indicates that the actual flow is not changing as expected.	Verify correct setup on the Valve Calibration screen. Perform a valve calibration. Inspect feedback sensor and rate control valve for damage.
Unstable flow control	The rate and section control module is having difficulty maintaining the target flow, possibly due to an incorrect	Check the Plumbing setting on the Valve Calibration screen Reduce Field-IQ system aggressiveness.

Message That Displays	Explanation	Possible Causes/Actions
	setup.	
Valve controller reported over-current		Possible causes: • Control valve is drawing too much current. • There is an electrical short somewhere.
Unknown valve error	This message shows if the FM-1000 integrated display does not understand the fault code that was received from the rate and section control module.	Probably due to incompatible firmware versions. Make sure that the correct firmware versions and the rate and section control module are installed. Report this fault to Trimble Support.
Unable to lock valve position.	An error occurred when attempting to lock the position of the control valve.	Probably due to incompatible firmware. Make sure that the correct firmware versions are installed on the FM-1000 integrated display and the rate and section control module.
Unable to start flow	An error occurred when attempting to control the valve.	Probably due to incompatible firmware. Make sure that the correct firmware versions are installed on the FM-1000 integrated displayand the rate and section control module.
Field-IQ unknown internal error	This message appears if the FM-1000 integrated display does not understand the fault code that was received from the rate and section control module. Probably due to incompatible firmware versions.	Make sure that the correct firmware versions are installed on the FM-1000 integrated display and the rate and section control module. Report this fault to Trimble Support.
The second pressure entry must differ from the first Please enter a different pressure	The pressure calibration process requires calibration at two different pressures. This message indicates that you entered the same pressure	

Message That Displays	Explanation	Possible Causes/Actions
	twice. ***Note*** *– Zero is a valid pressure for calibration.*	
No pressure change has been detected Please change the system pressure	The pressure calibration process requires calibration at two different pressures. This message indicates that the report from the pressure sensor did not change when the second reading was taken.	The pressure in the system must be changed between readings, for example, by either: • Opening or closing a valve • Starting or stopping the pump. If this message persists after the pressure is changed, check the installation and wiring of the pressure sensor.
Invalid setup for flow calibration		Check: • Total Nozzles in the Boom tab in the Field-IQ system setup • Width in the Hardware tab in Field-IQ Setup • Flow meter number
Invalid setup for granular calibration		Check: • Shaft Encoder Constant • Width in the Hardware tab in Field-IQ Setup
The second gate height entry must differ from the first Please enter a different height	The gate height calibration process requires calibration at two different gate heights. This message indicates that you entered the same gate height twice. ***Note*** *– Zero is a valid gate height for calibration.*	
No gate height change has been detected Please change the gate height	The gate height calibration process requires calibration at two different gate heights. This message indicates that the	If this message persists after the gate is moved, check the installation and wiring of the gate height sensor.

Message That Displays	Explanation	Possible Causes/Actions
	report from the gate height sensor did not change when the second reading was taken. The gate must be raised or lowered between readings.	
Gate not open Please open the gate	The Field-IQ system is attempting to dispense material, but the gate height sensor indicates that the gate is closed. Or if the gate height sensor is disabled, you did not enter a non-zero gate height.	Open the gate, or enter a non-zero gate height.If the gate is already open, check the installation and wiring of the gate height sensor.
The spinner pulses per revolution setting is invalid Please check the spinner sensor setup		
The tank/bin is empty Please refill tank/bin	The tank/bin level sensor has reported that the tank/bin is empty.	If this is incorrect, check the tank/bin sensor installation and wiring.
Valve Calibration Not Started.	This shows only during auto valve calibration, which is not available in firmware version 4.0. For safety reasons, when running an auto valve calibration for anhydrous, the vehicle must be moving at a speed of at least 2 mph. If the vehicle speed is above 2 mph, check that the FM-1000 integrated display is receiving valid GPS positions.	The vehicle is moving too slow to begin the automatic valve calibration. Increase the speed of the vehicle and start the valve calibration again
Valve Calibration Failed	The vehicle is moving too slow to continue the automatic valve calibration.	Increase the speed of the vehicle and start the valve calibration again.
Please turn off the master switch	The Field-IQ system is in a mode in which material application is not expected. It is asking for the master switch to be turned off to make the system safe.	

Message That Displays	Explanation	Possible Causes/Actions
NH3 is an irritant and corrosive to the skin, eyes, respiratory tract and mucous membranes and is dangerous if not handled properly. May cause severe burns to the eyes, lungs and skin. Skin and respiratory related diseases could be aggravated by exposure. It is recommended that protective gloves, boots, slicker and/or pants and jacket, and chemical-splash goggles that are impervious to anhydrous ammonia are worn at all times.	The application type is set to Anhydrous	
Application width is different from the control width. Please visit Field-IQ setup to reconfigure settings.	The total of the rate controller widths in the Hardware tab of the Field-IQ Setup must match the application width in the Implement Setup. A difference of about 0.4 inches is tolerated.	
Application width is different from the control and section width. Do you want the control and section width to be automatically adjusted to match the application width?	This message could appear when you exit the Field-IQ Setup. The total of the rate controller widths in the Hardware tab of the Field-IQ Setup must match the application width in the Implement Setup. A difference of about 0.4 inches is tolerated.	
Please select your NH3 unit	This messages shows if the application type is anhydrous and you attempt to exit the Field-IQ Setup without selecting the Anhydrous Units type ("lbs. Actual N" or "lbs. NH3") in the Features tab.	
The total number of rows	This message may appear when	

Message That Displays	Explanation	Possible Causes/Actions
assigned to sections (XX) exceeds the number of rows on the implement (XX) Press Continue to exit the Field-IQ Setup or press Edit to edit the row assignments.	you exit the Field-IQ Setup. The total of the numbers in the fields in the Sections tab exceeds the number of rows configured in the Implement Setup.	
XX implement rows are not assigned to sections Press Continue to exit the Field-IQ Setup or press Edit to edit the row assignments.	This message may appear when you exit the Field-IQ Setup. The total of the numbers in the fields in the Sections tab exceeds the number of rows configured in the Implement Setup.	
The number of nozzles must not be less than the total number of sections.	This message could appear when you exit the Field-IQ Setup. The total number of sections in the Hardware tab exceeds the Total Nozzles setting in the Rate tab. There must be at least as many nozzles as sections.	
Some devices have not been identified by serial number.	This message shows when you exit the Field-IQ Setup, if one or more of the serial number selection fields in the Hardware tab has no serial number selected.	
None of the expected Field-IQ system devices were found on the implement. Do you want to switch to another implement configuration?	The rate and/or section controllers that are identified in the current Field-IQ system configuration were not detected on the CAN bus.	
None of the configured Field IQ devices are connected. Do you want to remove all of the missing devices from the Field IQ hardware configuration?	The rate and/or section controllers that are identified in the current Field\ IQ configuration were not detected on the CAN bus.	

Message That Displays	Explanation	Possible Causes/Actions
Fence nozzle is enabled The configured sections exceed the maximum that is supported Please reduce the number of sections	If the left fence nozzle is enabled in the Sections tab of the Field IQ Setup, the leftmost section controller must not have more than 11 sections. If the right fence nozzle is enabled in the Sections tab of the Field-IQ Setup, the rightmost section controller must not have more than 11 sections.	
Cannot flush because the system is not calibrated.	This message appears if you try to use the Manual Flush button in the Tank/Bin tab of the Field-IQ Setup when a rate controller is not yet calibrated.	
Rate and Section Control Module and Rawson Control Module can not be present at the same time. Please disconnect either device before continuing setup.	When using multiple rate controllers for 1 material, they must all be of the same type.	
Field-IQ has been disabled Rate and Section Control Module and Rawson Control Module cannot be present at the same time.	When using multiple rate controllers for 1 material, they must all be of the same type.	
Field-IQ has been disabled One or more of the Field-IQ system devices requires calibration		Go to the calibration screen to calibrate a controller.
Please enter a valid flowmeter calibration constant	The flow meter constant must be greater than zero.	
Weighed NH3 (End) must be less than Weighed NH3 (Start).	This appears during anhydrous flow calibration. The process requires you to enter the weighed amounts of NH3 at the start and end of a	

Message That Displays	Explanation	Possible Causes/Actions
	run. If this warning appears, it is likely that you transposed the two amounts.	
No target rate The flush cannot be performed until a target rate has been set Please select a target rate	This will appear if you try to flush when the current target rate is zero.	
The calibration cannot be completed because the quantity dispensed is zero. Press Edit to edit the quantity or Restart to restart the calibration.	The granular flow calibration requires you to enter the amount that was dispensed. This message shows if the entered amount was zero.	
Calibration Failed The flow calibration was cancelled	The granular calibration failed because you cancelled the calibration or an error occurred.	
Calibration Failed No flow was detected	The granular flow calibration failed because there were no pulses reported from the shaft encoder.	Check that the shaft turns during calibration. Check the installation and wiring of the shaft encoder.
Calibration Failed No material was dispensed	The granular calibration failed because you entered zero for the actual amount of material dispensed.	
The selected target rate and speed cannot be achieved. Reduce target speed or target rate.	This shows during granular calibration if the target rate and target speed that you entered require the shaft to turn faster than the maximum RPM that is set in the Limits tab in the flow calibration screen.	
The selected target rate and speed may not be achieved. It is recommended that the target speed be increased.	This shows during granular calibration if the target rate and target speed that you entered require the shaft to turn slower than the minimum RPM that is set in the Limits tab in the flow	

Message That Displays	Explanation	Possible Causes/Actions
	calibration screen. If you choose to continue, the Field-IQ system tries to run the system below the minimum RPM limit.	
The calibration constant changed significantly. For best results it is recommended that the calibration be repeated.	This message shows at the end of the granular calibration process, if the calibration constant changed by more than 30%.	
Motor failed to start	This message shows if the hydraulic motor fails to start during the Rawson Control Module Hydraulic Test.	
Motor stopped unexpectedly	This message shows if the hydraulic motor stops unexpectedly during the Rawson Control Module Hydraulic Test.	
The number of seeds dispensed did not match the number of seeds expected. Do you want to adjust the calibration constant in order to attain the target rate? Adjusting the calibration constant will alter the seed spacing.	This message may appear during calibration of a Rawson Control Module in a planter application. If the calibration test does not dispense the expected number of seeds, it is likely that the seed pick up is not operating perfectly. You can adjust the calibration constant to compensate for this but the seed spacing will be inconsistent where seeds are missed or doubled up.	
Calibration Failed The motor failed to turn	This message shows if the hydraulic motor fails to turn during calibration of a Rawson Control Module.	
Speed Too Low The vehicle is moving too slow for safe anhydrous	For safety reasons, the Field-IQ system will not apply anhydrous in auto rate control mode at	

Message That Displays	Explanation	Possible Causes/Actions
application. Increase the speed of the vehicle.	speeds below 2 mph. Either increase the speed or switch to manual mode.	

Anhydrous Rate Control troubleshooting

Unable to open valve.

1. Check all for proper valve type in rate control setup.
2. NH3 will not operate unless vehicle is moving over 1.5 MPH.

If settings are correct:

1. Disconnect the tank from the system.
2. Set the system up as a liquid.
3. Check that system has control of the valve when in manual rate. (During this procedure a no flow detected warning may appear. This is normal as there is no flow going through the system)
4. For FM-1000 integrated display 6.5 and up. System will run in diagnostics. (Only attempt after trying the previous steps.)

If system will run in diagnostics:

1. Check color of sections in the run screen. If sections are red there is an issue.
    a. Check that system is not outside a boundary (open a new field to test)
    b. Check that system is not over a previously applied area.
    c. Check that system has a "fixed" GPS position.
2. Check that the material has not been disabled in the material detail screen.

Unable to reach target.

1. Check that system control components are sized properly.
2. See if the valve will open any further when set to manual rate. (if not, may be a tank or cooler limitation)

If system is sized properly for rate:

1. Check minimum and maximum flow settings.
2. Check that the flowmeter calibration is close to the number listed on the tag.

If settings check ok:

Check that control valve has been calibrated.

If PWM, check upper PWM limit under advanced parameters. May need to be set to 100%.

Rate fluctuates around target.

1. Check that a drive calibration has been performed.
2. Turn valve on and set rate switch to Manual to lock the valve.
3. If the rate still fluctuates check the flowmeter. (may be a cooler or a tank issue)

If the rate holds in manual, the valve needs to be tuned.

Any Implement Section Control troubleshooting

Section Control does not work.

1. Check that section control has been completely set up.
2. Check that switching type is set up properly. Boom valve Vs. air clutch
3. Check that auxiliary power and auxiliary I/O on the Field-IQ cables are connected. (if present)

If system is set up properly:

1. Run a flow calibration (catch test.) This will force the sections on and confirm that all cabling and connections are correct.
2. Operate the system in diagnostics. (FM-1000 integrated display only) Arm sections at bottom of the screen and perform a catch test.

If system works in diagnostics:

1. Check color of sections in the run screen. If sections are red there is an issue.
    a. Check that system is not outside a boundary (open a new field to test)
    b. Check that system is not over a previously applied area.
    c. Check that system has a "fixed" GPS position.
2. If sections are yellow, boom valves should be on but no flow is detected.
3. Check that the material has not been disabled in the material detail screen.

Section control timing is off.

1. Check that all implement and vehicle measurements are correct. (Do not guess. These measurements are crucial for an accurate application.)
2. Check that start and end overlaps have not been adjusted to take care of timing issues. (These settings are only used for intentional overlap!)

If sections are coming on too late or shutting off too late:

1. Check that start and end overlaps are set to the desired intentional overlap.
2. Raise the on latency to allow the section to turn on earlier.
3. Raise the off latency to allow the system to start turning off earlier. Typically these settings are no more than 5 seconds. If they are higher double check implement measurements.

If sections are coming on too early or shutting off too early:

1. Check that start and end overlaps are set to desired intentional overlap.
2. Lower the on latency if the system is turning on too soon.
3. Lower the off latency if the system is shutting off too soon.
4. If settings are set to 0 and system is still not accurate check implement measurements.

Any Implement Sensor troubleshooting

Erratic sensor readings.

1. Has sensor been calibrated?
2. Check that sensor is specified properly for the system.
3. Make sure the feedback voltage is in the right range. Pressure sensors are 0 to 5 V.

Erratic flowmeter / encoder readings.

1. Check all cabling and connections.
2. Check that the encoder constant is correct.
3. Check that there isn’t a rate control issue by setting the Rate to Manual to lock the valve.
4. Check that the meter is sized properly for the application.
5. Check that there is nothing mechanically wrong with the meter.

Lift switch won't calibrate.

1. Check that the switch is plugged in
2. Check that switch works. Use a volt meter to check continuity on the switch. One way it will be open the other way it will be a closed circuit.

Switch is functional.

1. Jump the A and B terminals at the module harness to bypass cabling. If this works check all cabling.
2. If previous test didn't work set up a new implement. May be a bad module.
3. Check that the OEM harness is not supplying constant power to signal wire.

Planter Rate Control troubleshooting

Unable to turn motor.

1. Check valve type in Rate control set up.
2. Check that hydraulic motor is receiving flow.
3. Check that motor will pass a drive calibration (PWM) only.
4. Perform a hydraulics test (Rawson).

If the motor will run in the calibration screen, check the operation of the system in the Field-IQ diagnostics screen.

1. Enter a manual speed and turn all sections on.
2. Arm all sections at the bottom of the screen.
3. If equipped with an implement switch make sure it is calibrated and shows the implement in the running position.

If motor ran in diagnostics screen:

1. Check color of sections in the run screen. If sections are red there is an issue.
    a. Check that system is not outside a boundary (open a new field to test)
    b. Check that system is not over a previously applied area.
    c. Check that system has a "fixed" GPS position
2. Check that the material has not been disabled in the material detail screen.

Unable to reach target rate.

1. Check that maximum meter RPM has not been set to low. System defaults to 120 RPM
2. Rawson: Check that maximum motor RPM has been set to 300 RPM
3. Check Gear ratio and encoder constant (gear ratio needs to be figured from the encoder to the meter.)

4. Check info tab in the drive calibration screen. Make sure target rates and speeds are logical. If they are not this usually represents improper Field-IQ system set up.

If the settings check out okay:

1. Check that the control valve has been calibrated. If PWM, check upper PWM limit under advanced parameters. May need to be set to 100%.
2. Rawson: Check that the motor will reach 300 RPM in the hydraulic test. If it will and system still can't reach rate check that the gear ratio will allow system to reach target rate. Formula on page.

If the rate fluctuates around the target:

1. Check that a drive calibration has been performed.
2. If population monitoring is on, disable it to see target rate of the motors. If system holds rate it is a seed monitoring issue.

Drive calibration is performed (PWM):

1. Check that motor(s) have sufficient hydraulic flow.
2. Raise the PWM base frequency to 200Hz. (if PWM valve is a raven set to 120hz)

Rawson:

1. Check that drive is running above 100 RPM. Adjust gear ratio to achieve proper RPM.
2. Isolate the drive from the seed shaft. Make sure the drive operates properly with no load.

No communication with seed sensors.

1. Check that the Auxiliary I/O connector is plugged in.
2. A power cycle must be performed every time a cable is plugged in. The system only looks for the sensors on boot up. If they are not present it won't look for them until power is cycled.
3. Check that sensors are compatible with Field-IQ.

If the cables are connected:

1. Check for the right harness.
2. CT harness (John Deere) will always have pins 27 and 28 populated. These will be a power and a ground that provides 8 V to the sensors. DO NOT ASSUME YOUR JD PLANTER HAS A CT HARNESS IT MAY HAVE BEEN RETROFITTED WITHA PM STYLE HARNESS.
3. PM harness. (Also referred to as a Dickey John or DJ harness. Typically on all planters but JD.) These harnesses will have pins 24-27 populated. 24 and 25 are 8 V power. 26 and 27 are ground.

If you have the correct harness and have power to the sensor:

Check that all the sensors have 8 V power and 5 volt signal. If not this could represent a bad seed sensor harness.

Planter Seed Sensor troubleshooting

No communication with seed sensors.

1. Check that the Auxiliary I/O connector is plugged in.
2. A power cycle must be performed every time a cable is plugged in. The system only looks for the sensors on boot up. If they are not present it won't look for them until power is cycled.
3. Check that sensors are compatible with Field-IQ.

If the cables are connected:

1. Check for the right harness.
2. CT harness (John Deere) will always have pins 27 and 28 populated. These will be a power and a ground that provides 8 V to the sensors. DO NOT ASSUME YOUR JD PLANTER HAS A CT HARNESS IT MAY HAVE BEEN RETROFITTED WITHA PM STYLE HARNESS.
3. PM harness. (Also referred to as a Dickey John or DJ harness. Typically on all planters but JD.) These harnesses will have pins 24-27 populated. 24 and 25 are 8 V power. 26 and 27 are ground.

If you have the correct harness and have power to the sensor:

Check that all the sensors have 8 V power and 5 volt signal. If not this could represent a bad seed sensor harness.

Sprayer/Liquid Strip Till Rate Control troubleshooting

Control valve will not open.

1. Check valve type in Rate control set up.
2. Check that hydraulic motor is receiving flow (PWM)(pump servo).
3. Check that the product pump is on and producing flow (Servo).

For PWM:

1. Check that system will pass a drive calibration.
    a. If not check that max flow setting has not been set too high. This setting is dependent of nozzle size. Refer to a tip chart.
    b. If system still will not pass perform the calibration with no tips.
2. Sprayers with a pump arming relay:

Check that the pump arming relay is working by checking that the relay clicks on when the pump is armed. (there will be 12 V at terminal 85 on the relay)

For Servo:

1. Operate the valve in the drive settings screen.
2. Check that there is manual control of the valve in manual rate control. If there is no control check cabling.
3. If valve will work in manual, it may need to be calibrated to work in auto. See calibration procedure.

If the system ran in Diagnostics:

1. Check color of sections in the run screen. If sections are red there is an issue.
   a. Check that system is not outside a boundary (open a new field to test)
   b. Check that system is not over a previously applied area.
   c. Check that system has a "fixed" GPS position.
2. Check that the material has not been disabled in the material detail screen.

Unable to reach target rate.

If unable to reach target:

1. Check that system control components are sized properly.
2. Check that nozzles are sized properly for sprayer.
3. See if the valve will open any further when set to manual rate. (if not may be a pump issue)

If system is sized properly for rate:

1. Check minimum and maximum flow settings.
2. Check that the flowmeter calibration is close to the number listed on the tag.

If settings check ok:

Check that control valve has been calibrated.

If PWM, check upper PWM limit under advanced parameters. May need to be set to 100%.

Rate fluctuates around target.

1. Check that a drive calibration has been performed.
2. Check that tips/orifices are sized appropriately for the system.

For PWM / Servo systems:

1. You may need to manually tune the valve.
2. Set valve to manual rate. With the rate in manual the valve should be "locked". If the rate still fluctuates check the pump and the flowmeter.

For Rawson:

1. Check that the drive is running above 100 RPM.
2. Isolate the drive from the pump. Make sure the drive operates properly with no load.

Spreader Rate Control troubleshooting

Unable to turn motor.

1. Check valve type in Rate control set up.
2. Check that hydraulic motor is receiving flow.
3. Check that motor will pass a drive calibration (PWM) only.
4. Perform a hydraulics test (Rawson).

If the motor will run in the calibration screen, check the operation of the system in the Field-IQ diagnostics screen.

1. Enter a manual speed and turn all sections on.
2. Arm all sections at the bottom of the screen.
3. If equipped with an implement switch make sure it is calibrated and shows the implement in the running position.

If motor ran in diagnostics screen:

1. Check color of sections in the run screen. If sections are red there is an issue.
    a. Check that system is not outside a boundary (open a new field to test)
    b. Check that system is not over a previously applied area.
    c. Check that system has a "fixed" GPS position
2. Check that the material has not been disabled in the material detail screen.

Rate fluctuates around target.

1. Check that a drive calibration has been performed.
2. Set the Rate to Manual. With the drive "locked" the drive should be running steady. If the rate is still fluctuating check the encoder.

If drive calibration is performed, check that motor(s) have sufficient hydraulic flow.

For Rawson:

1. Check that drive is running above 100 RPM. Adjust gate height to achieve proper RPM.
2. Isolate the drive from the shaft if possible (try to minimize the load on the drive.) Make sure the drive operates properly with little or no load.

FieldLevel II diagnostics valve test

1. At the *Home* screen, tap .
2. At the *Configuration* screen, tap FieldLevel II and then tap **Diagnostics**.
3. You can test valve functionality at any time at this screen without the need for a GPS position or an active field design open by either tapping:

- **Auto**: To engage the system (this sets the current elevation as Target Height = 0.0) and tests its response as height offsets are added or subtracted from the current elevation, based upon the current coarse offset entered into the system
- **Up** or **Down**: To manually stroke the valve to 100% command in the required direction to verify valve performance and wiring accuracy

GPS status

1. At the *Home* screen, tap .
2. At the *Configuration* screen, tap GPS Receiver and then tap **Diagnostics**. The *GPS Status* screen. Use this screen to check that the GPS receiver is outputting the expected data.

To analyze the GPS signal, see Serial Comms (page 433) to view raw serial data.

GreenSeeker diagnostics

The *GreenSeeker Diagnostics* screen reports on the quantity of sensors detected on system and any error conditions.

1. At the *Home* screen, tap .
2. At the *Configuration* screen, tap GreenSeeker and then tap **Diagnostics**. The *GreenSeeker Diagnostics* screen displays.

The hardware and firmware version information at the top of the diagnostics screen indicates the display and RT200 are communicating.

Incorrect data

The RT200 system monitors the sensors for proper operation, and if a sensor reports incorrect data, the data is not included in the rate control calculation. Incorrect data can come from mud on the sensor lenses, sensors viewing concrete, snow, wet asphalt, or other non soil or non plant surface.

Error conditions

Error conditions include sensors disconnected from the CAN bus, or a sensor transmitting invalid data.

Invalid data could occur if the sensor malfunctions, or more commonly, if it is seeing a target other than plants and soil.

For example, when setting up the system, the sensors may be pointed into the air or against wet asphalt. Either of these conditions will likely generate an error code from a sensor.

Error	Code	Explanation
-1	Red > NIR	Red reflectance higher than NIR
-2	BOTH < .01	Both reflectances are below 0.01
-3	RED < .01	Red reflectance below 0.01
-4	NIR < .01	NIR reflectance below 0.01
-5	BOTH > .98	Either reflectance above 0.98
-9	NIR < .015	NIR net reflectance below 0.15

Row-Guidance diagnostics

1. At the *Home* screen, tap .
2. At the *Configuration* screen, tap Row Guidance and then tap **Diagnostics**.

Item	Explanation
Offline Distance	
Status	Status of the sensor
Enable / **Disable**	Tap to enable or disable sensors
Voltage	Voltage for the left and right sensor

Item	Explanation
Voltage status	Status for the left and right sensor

Vehicle Sync diagnostics

1. At the *Home* screen, tap .
2. At the *Configuration* screen, tap Vehicle Sync and then tap **Diagnostics**. The *Vehicle Sync Diagnostics* screen displays.
3. Check the signal quality for the WiFi connection.
4. View the other vehicles that are on the selected channel.

Yield Monitoring diagnostics

1. At the *Home* screen, tap .
2. At the *Configuration* screen, tap Yield Monitoring and then tap **Diagnostics**. The *Yield Monitoring Diagnostics* screen displays.

Status tab

The Status tab includes information on the optical and moisture sensors.

Optical Sensor Item	Explanation
Noise level	Indicates how clean the optical sensor signal is and if the noise level is too high. This number should be less than 30% for best performance. If larger values are seen, check the following: • Optical sensor interference • Worn paddles • Optical sensors protruding too far into the chamber • Installation in the wrong location (too low on elevator).
Elevator speed	Frequency of paddles, typically 15 Hz to 20 Hz • Unusually low numbers: Indicate the system is not seeing the paddles This most likely occurs when running empty. Inspect the optical sensor installation. • Unusually high numbers: Typically be accompanied by large noise levels Inspect the optical sensor installation.
Percent Dark	The duty cycle. This data can be used to determine if you are close to exceeding the capacity of the combine.

Moisture Sensor Item	Explanation
Sensor Value	Percent of moisture and the raw sensor value Can be used by support or engineering if troubleshooting is necessary.
Temperature	

Yield Monitor error messages

State 1 - During boot up

Cause	Actions
60 Series Moisture unit Head unit Armrest unit 70 Series Moisture sensor CC1 unit Cab unit Corner post YM 2000 Cannot detect YM 2000 Serial port	1. Ensure that the correct cable is installed. 2. Ensure the display is communicating with the CAN bus (system / diagnostics / serial port / Port A/B). Is there another value other than zero for CAN messages? 3. For 60 Series Combines: Check if Crop Type will change on the Greenstar display after Crop Type on the FM-1000 integrated display has been changed. 4. For 70 Series Combines: Change the Crop Type in the command center and make sure it changes on the FM-1000 integrated display. 5. Raise the head up or down to see if the display will show a change for header height. 6. If step 1 and step 2 resolve the issue, log field data.

State 2 - During boot up

Cause	Actions
Never sees the armrest, header unit, moisture sensor, or reports which one is not visible by the display.	1. Ensure the display is communicating with the CAN bus (system / diagnostics / serial port / Port A/B). Is there another value other than zero for CAN messages? 2. For 60 Series Combines: Make sure Moisture Sensor has version 1.20C loaded. 3. For 60 Series Combines: Check if Crop Type will change on the Greenstar display after Crop Type on the FM-1000 integrated display has been changed. 4. For 70 Series Combines: Change the crop type in the command center and make sure it changes on the FM-1000 integrated display. 5. Raise head up or down to see if the display shows a change for header height.

State 3 - During boot up

Cause	Actions
Will show which controller is not visible (armrest, header unit, moisture sensor).	1. Ensure the display is communicating with the CAN bus (system / diagnostics / serial port / Port A/B). Is there another value other than zero for CAN messages? 2. For 60 Series Combines: Make sure Moisture Sensor has version 1.20C loaded. 3. For 60 Series Combines: Check if Crop Type will change on the Greenstar display after Crop Type on the FM-1000 integrated display has been changed. 4. For 70 Series Combines: Change the crop type in the command center and make sure it changes on the FM-1000 integrated display. 5. Raise head up or down to see if the display shows a change for header height.

State 4

Cause	Actions
Display has lost communication with the CAN bus.	1. Check cabling. 2. Recycle power (power down the display and the combine and wait 20 seconds before powering the display and the combine back up). 3. Make sure other logging devices are not connected to the CAN bus (disconnect Mobile Processor or GS2 display).

Yield Monitor troubleshooting

The display is not mapping.

1. Make sure the display Header Height setting is lower than John Deere's setting.
2. Ensure that the crop type is the same.
3. The machine must be in normal harvesting operation mode.

The display stops mapping periodically through the field.

Cause: The header could be raising and lowering past the setting for Stop Logging Header Height.

Action: Increase the Header Height setting on the display.

Display yield information does not match John Deere's information.

Cause: Different crop types may be selected.

Action: Verify the crop types match in both displays.

The display shows a major jump or extremely different weight values from those shown on the John Deere monitor.

Cause: The Stop Head Height setting is lower than what the John Deere monitor shows. The John Deere monitor could be logging more data than the FM-1000 integrated display logs, therefore showing a larger value.

Action: Set the Head Height to 100% on the John Deere display.

Yield Monitoring warning messages

Warning message	Explanation
Unable to calibrate yield monitor.	Occurs when tare calibration fails.
Invalid selection. Please select one of the calibration types below this item.	The user clicked on the wrong line in the Yield Monitor *Calibration* menu.
No Connection. Please check connections.	User attempted to calibrate a device that is not connected.
Failed to detect yield sensor!!!	Some setup parameters cannot be edited because the yield monitor is not connected.
Yield sensor has not uploaded configuration into FmX.	Some setup parameters cannot be edited because they have not been received from the yield monitor.
Trimble Yield Monitor not found—check cabling and fuses—check Yield Monitor Setup.	Yield monitor not detected.
Trimble Moisture Sensor not found—check cabling and fuses—check Yield Monitor Setup.	Moisture sensor not detected.
One or more Yield Monitor devices were disconnected.	A device has been disconnected.
Moisture out of range. Check the sensor is positioned properly and not being struck by paddles, and there is no free water or wet soil on sensor surface.	Bad reading received from moisture sensor.
The label cannot be oriented along the same axis as the connectors.	Invalid selection in IMU sensor orientation setup.
Choose the options that match the Trimble Yield Monitor's mounting orientation.	Attempting to perform roll calibration before setting a valid orientation.
Would you like to calibrate the roll sensor?	
For accurate Roll Offset calibration you must turn the vehicle around.	User did not turn the vehicle around for second step of roll calibration.
Please select one or more loads to use for calibration. Tap the check mark to select a load.	Attempted to run load calibration with no loads selected.
Would you like to apply the calibration to the current field?	

Warning message	Explanation
Current field is successfully recalibrated.	
Unable to recalibrate current field.	Calibration was unable to be applied to field, possibly due to invalid data in field.
The calibration will be cleared. Are you sure you want to do this?	User tapped **Reset** in a calibration screen.
The yield sensor calibration has been reset.	User confirmed yield calibration reset.
The moisture sensor calibration has been reset.	User confirmed moisture calibration reset.
The temperature sensor calibration has been reset.	User confirmed temperature calibration reset.
No load information is available. You must record some data by harvesting some crop before you can run this calibration.	There are no loads for the current crop type.
This load is too small to be used for calibration or contains invalid data.	The load data is not valid for calibration, usually because the load is too small.
Optical sensor is not responding.	Optical sensor failed to respond during tare calibration.
No loads have been recorded. Use the 'New Load' button on the map screen to record a load.	Displayed in load details dialog if there are no loads for the current crop type.
This load cannot be deleted because it is used in the yield calibration.	Loads that were used for the current yield calibration cannot be deleted.
This load cannot be deleted because it is used in the moisture calibration.	Loads that were used for the current moisture calibration cannot be deleted.
Loads cannot be recorded when there is no field open.	Occurs when tapping **New Load** in the diagnostic screen if no field is open.
You have chosen to delete some loads. Are you sure you want to do this?	User tapped **OK** after selecting loads for deletion in Load Details screen
The system is not yet ready to delete fields or events.	The display needs some time to determine whether deletion of the field/event would remove a load that was used for calibration. Try again later.
Accepting the new test weight will affect the current calibration.	
The average moisture will be reset to the	Manual moisture will cause the average to be

Warning message	Explanation
manually entered moisture setting.	reset.
Do you want to reset average moisture and recalculate dry yield?	Requesting confirmation when setting manual moisture.
Closing this field will cause your current load being recorded to be automatically finished.	The user has chosen to close the field before ending the load.
Would you like to clean out the moisture sensor?	The display offers to clean out the Trimble moisture sensor when shutting down.
Would you like to begin a new load? The Test Weight for the new load is XXXXX.	User tapped **New Load** and New/End Load Confirmation is enabled in setup.
What would you like to do? End Load, ends the current Load. Cancel, continue with the current Load. New Load, closes this Load and starts another Load.	User tapped **End Load** and New/End Load Confirmation is enabled in setup.
This operation will delete one or more loads that were used in the most recent yield or moisture calibration. These loads will not be available for use in any future recalibration.	User is deleting a client, farm, field or event that contains one or more loads that were used in the current calibration.
CLAAS YIELD MONITOR: WARNING. Uninitialized.	Error in communication with Claas yield monitor.
CLAAS YIELD MONITOR: WARNING. Cannot configure CAN port.	Error in communication with Claas yield monitor.
CLAAS YIELD MONITOR: WARNING. Cannot detect the CLAAS CAN bus.	Error in communication with Claas yield monitor.
CLAAS YIELD MONITOR: WARNING. Cannot configured Yield Monitoring.	Error in communication with Claas yield monitor.
CLAAS YIELD MONITOR: WARNING. Lost CAN communications.	Error in communication with Claas yield monitor.
CLAAS YIELD MONITOR: WARNING. Error state.	Error in communication with Claas yield monitor.
CLAAS YIELD MONITOR: WARNING. Head configuration differs between the FmX and CEBIS.	The implement width in the display setup must be set to match the width that was set in the Claas yield monitor.
YIELD MONITOR: CAN bus error (state#XX). Failed to detect the following device(s):-…..	John Deere moisture sensor, head unit or armrest unit not detected. Check port selection.

Warning message	Explanation
YIELD MONITOR: CAN bus error (state#XX).	Unknown error when communicating with John Deere yield monitor.
YIELD MONITOR: Failed to update crop type!!!	Unable to set grain type in John Deere yield monitor. Probable communication error.
YIELD MONITOR: Configuration Error (state#XX). Verify the FmX is connected to the CAN bus and CAN bus/combine series configuration.	Lost connection with John Deere yield monitor.
YIELD MONITOR: Moisture sensor is not connected	Trimble moisture sensor connection error.
YIELD MONITOR: Temperature sensor is reporting values outside of a valid range	Bad reading received from temperature sensor.
YIELD MONITOR: Field changed on YM2000. Verify that the Crop type is not inadvertently changed on YM2000	YM2000 reported a "field" error.
YIELD MONITOR: Load changed on YM2000. Verify that the crop type is not inadvertently changed on YM2000.	YM2000 reported a "load" error.
YIELD MONITOR: Cannot Detect YM2000 Serial Port (state#XX) !!!	Lost connection with YM2000 yield monitor.

CHAPTER 20

Glossary

A

A+ line
A guidance line you define on your field. The A+ line is defined fixing a point, then heading in a direction. Guidance lines are for use with automated steering.

AB line
A guidance line you define on your field. You set a beginning point (A) and an end point (B). You use guidance lines for use with automated steering.

Accelerometer
A device that measures non-gravitational acceleration.

Access path
A space between your guidance lines. They can be useful if there is road (or other field feature that breaks the consistent flow of swaths) through the middle of your field.

Aggressiveness
The measure of how strongly the system makes steering changes.

Autonomous GNSS positioning
Autonomous GNSS positioning uses no corrections. The rover receiver calculates its position using only the GNSS signals it receives. This method does not have high absolute accuracy, but the relative accuracy is comparable to the other methods.

RTK GNSS positioning uses the RTK positioning method to achieve centimeter-level accuracy. To use the RTK method, you must first set up a base station. The base station uses a radio link to broadcast RTK corrections to one or more rover receivers.

B

Benchmark
A point on the field with GPS coordinates assigned to it.

Blade height
Current height of the blade shown as a relative height or a GPS height depending on settings selected.

Boot depth
Depth of the boot when installing tiles or the depth of the blade when cleaning surface ditches.

Boundary
A line indicating the border surrounding a field.

C

CenterPoint™ RTK for radio
Positioning correction service for radio communication systems. Requires access to a base station located within a eight-mile radius (approximately) from your farm. An RTK base station sends corrections via a radio transmitter to a mobile receiver attached to your vehicle. Works well for farms within 8 miles of an established RTK base station or base station network, without line-of-sight obstructions such hilly terrain or an abundance of trees.

CenterPoint™ RTX™
Positioning correction service for satellite communication systems. Delivers GPS or GNSS enabled corrections via satellite directly to your receiver. Does not require a base station or cellular data plan. CenterPoint RTX corrections are provided on as subscription basis.

CenterPoint RTX for cellular
Positioning correction service for cellular communications. Delivers corrections via cellular network directly to your receiver. Requires a cellular data plan.

CenterPoint™ VRS™
Virtual reference station. Positioning correction service for cellular communication systems. Enables RTK (Real-Time Kinetic) corrections over a large geographic area where robust cellular data coverage is available. Provides high accuracy for guidance applications throughout the whole coverage area. Requires a cellular data plan. Uses a cellular communication modem, such as the DCM-300 or Ag3000. Relies on CORS.

Clean grain elevator
After grain has been separated from the rest of the plant, the clean grain auger moves the grain from the separator to the grain bin.

Client
The customer for whom the work is being done.

Composite slope

The true angle of the fall of the design. In other words, the angle of the slope when two slope angles are combined.

Controller orientation
Correctly associate the outputs of the Autopilot controller sensors with the direction of the vehicle.

Correction age
Time since the last GPS correction was received.

Correction service
A service which provides corrections to create a higher GPS accuracy.

CORS network
Continuously Operating Reference Station. A network of GPS/GNSS reference stations situated within the coverage area to transmit RTK (Real-Time Kinetic) corrections to the cellular modem. The distance between the reference stations and the modem on the vehicle does not affect accuracy. CORS works well in areas with spotty RTK radio tower coverage.

Curved line
A guidance line you define on your field. You begin recording and drive until you are at the end of the curved line or segment, then stop recording. Guidance lines are for use with automated steering.

Cut
A point on the field where dirt needs to be removed. A cut occurs when the existing field is higher than the proposed field surface.

Cut/Fill ratio
Difference between the blade height (1) and the target height (4):

When cut (dirt to be removed) is displayed, the current ground is above the target. The height indicator arrow turns red and points down, which means that the blade needs to move down to reach the target height.

When fill (dirt to be replaced) is displayed, the current ground is below the target. The height indicator arrow turns red and points up, which means that the blade needs to move up to reach the target height.

D

Data Dictionary
A set of data that contains categories for entry data when you are setting up client, farm, field and event.

Design height
The height of the land called for in a design.

Design slope
The slope of the land called for in a design.

DGNSS

Differential GNSS positioning. The GNSS receiver uses corrections from WAAS/EGNOS satellites or from OmniSTAR HP, XP, G2, or VBS satellites. These differential systems use special algorithms to provide differential corrections that allow the rover receiver to calculate its position more accurately. Not all corrections services support the use of GLONASS satellites in their solution.

DGPS
Differentially corrected Global Positioning System (GPS).

E

EGNOS
European Geostationary Navigation Overlay Service. An SBAS operated by the European Space Agency.

Event
A precision agriculture activity on a particular field. For example: planting seed, applying fertilizer or lime, or spraying with fungicide, herbicide or insecticide.

F

Farm
A collection of fields.

Field
Settings created in the FM-1000 integrated display to represent an actual field, one or more parts of an actual field, or a group of two or more fields. Field profiles include guidance lines for steering, pivot patterns and landmarks.

Fill
A point on the field where dirt must be added. A fill occurs when the existing field is lower than the proposed field surface.

Freeplay
Movement in the steering linkage through which a movement of the steering wheel will cause no change in wheel angle.

Freeplay offset
A value entered to give the control system a way to account for freeplay during guidance.

G

GDD

Growing Degree Days. A measurement of heat units since planting above a prescribed base temperature.

GLONASS
A Russian space-based satellite navigation system.

GNSS
Global Navigation Satellite System. A system of GPS US and Russian satellites that provide information about geo-spatial positioning. A GNSS receiver can determine its longitude, latitude and altitude. In the future, GNSS will also use Chinese GPS satellites.

GPS
Global Positioning System. A space-based satellite navigation system. A GPS receiver can determine its position by using GPS satellites.

GPS autonomous positioning
A mode of operation in which a GPS receiver computes position fixes in real time from satellite data alone, without reference to data supplied by a base station. Autonomous positioning is the least precise positioning procedure a GPS receiver can perform, yielding position fixes that are precise to ±100 meters.

H

HDOP
The horizontal component of PDOP.

Header height
A sensor that indicates the position of the head.

I

IMD
Inertial Measurement Device.

IMEI
International Mobile Station Equipment Identity. A number to identify mobile equipment. The GSM network uses this number to identify valid devices. The IMEI number has no relationship to the subscriber.

Implement steering

A system that actively steers the implement being towed by a vehicle.

IMU
Inertial Measurement Unit. An electronic device that measures and reports on a vehicle's velocity, orientation, and gravitational forces, using a combination of accelerometers and gyroscopes.

Integrated radio

Trimble integrated radios contain a radio antenna integrated with the GNSS receiver or display in a single unit. These integrated radios receive corrections transmitted by Trimble GNSS RTK base stations.

L

Logging
Also called coverage logging. Logging records the area that you have covered when you carry out an operation, for example applying fertilizer to a field.

License
A license enables a software feature, and is valid for an unlimited duration. A license does not need to be activated, but does need to be assigned to and delivered to a specific display. Assignment and delivery of a license occurs on the reseller portal.

M

Manual override
Required for platforms that employ a pressure transducer for the manual override function. Change the default only if the operation of the manual override function is unacceptable

Master benchmark
Before you can create a survey, you must set at least one point at a known location called a benchmark. When you create a benchmark, the GPS receiver obtains and records location information from the base station for that specific point in your field. The first benchmark you create on a field is the master benchmark and displays as an orange flag labeled **MB**. Field coordinates are calculated from this point.

Material
A product that is controlled by a PWM valve, Servo valve, or Rawson drive. You can use a planter (seed), liquid, granular seed and granular fertilizer, all of which have different setup parameters.

Multipath error
An error caused by the interference of the same signal reaching the receiver by two different paths: once via the direct path, and once via a reflection. A major cause of GPS errors.

N

NDVI

Normalized Difference Vegetative Index. Commonly used to measure plant health and vigor. NDVI = (NIR_reflected Red_reflected)/(NIR_reflected + Red_reflected).

NMEA standard

An electrical, hardware and data standard designed by the National Marine Electronics Association that dictates the content and format of communication between GPS receivers and other devices. NMEA messages include data that provides location and accuracy, the number of satellites being used, the dilution of precision and signal strength.

NEU

Nitrogen Use Efficiency. A percentage of nitrogen taken up by the plant. For example, an NUE of 60% means that 6 lbs. of nitrogen fertilizer is expected to be used by the plant that year for every 10 lbs. applied. For more information, visit www.nue.okstate.edu.

NRS

Nitrogen Rich Strip. An area for determining the amount of nitrogen being made available to the plant by the environment (mineralization, etc), and importantly this year's expected maximum yield potential and response to additional nitrogen.

O

OEM moisture sensor

Moisture sensor installed by the combine manufacturer.

Offset

Difference between design height and target height. By using the offset buttons, you can create a plane that is parallel to the original design.

P

Parity

When used with a serial port, an extra data bit is sent with each data character to detect errors in transmission.

PDOP

Position Dilution of Precision. A calculation that takes into account the satellites that can be seen, how high they are and their bearing. The outcome of the calculation is an estimation of how prone to error your GPS position is. The lower the value, the more accurate your position. You may wish to plan your field work for periods of low PDOP. Generally, the more satellites in view, the better (lower) the PDOP.

Pivot

A guidance pattern you define for your field by recording the outer circular boundary of the pivot area and then entering a value to compute the rows within the pivot. Guidance patterns are for use with automated steering.

R

RangePoint™ RTX™
Positioning service for satellite communication systems. RangePoint RTX works with a built-in GNSS receiver. Does not require a base station or cellular data plan.

Rate switch for Field-IQ
Used to select Preset Rate 1, Preset Rate 2, or Manual Rate Control.

Real Time Kinematic (RTK)
A navigation technique to improve the information received from satellite-based positioning systems. Used with GPS, GLONASS and Galileo.

RI
Response Index. An indication of how the crop will respond this season to additional nitrogen.

Roll correction
Compensates for antenna height and static roll caused by minor variations in the navigation controller and the mounting of the GPS receiver.

Row
The individual row unit which seed comes from on the planter. This can be controlled individually as a single row section, or as a group with other rows in a multiple row section.

Run screen
The screen where you perform field activities.

S

SBAS
Space Based Augmentation System. A system of Earth-based systems at points surveyed for location accuracy that measure satellites, signals and factors that can impact the signals. The SBAS then broadcasts corrections to satellite signals to improve accuracy.

Scintillation
Causes extreme fluctuations in signals that are received. Scintillation can be caused by turbulence that creates air pockets with different temperatures and densities.

Section
A number of rows or spray nozzles that are controlled by existing shut-off valve, Tru Count air clutches, or Tru Count LiquiBlock valves. A section can have either a single row/nozzle or multiple rows/nozzles depending on how the system is set up.

Section Control Module
Controls 12 sections/rows per module with up to 4 modules (48 module sections / rows).

Service

A service is a subscription to an application that lasts for a specific amount of time, such as one or two years. You associate a service with a specific display that can be delivered wirelessly, through a QR code included in an email or through download to a computer.

Signal Input Module
The signal input module (SIM) can interface with existing equipment inputs to control on-screen buttons and features.

Singulation
The percentage of time an individual seed is placed for every intended drop.

Slew time
The amount of time that the front wheels take to move from the far left to the far right position and back.

Slope heading
The heading direction of the slope.

Steering deadzone
The amount of pressure that the system must apply to the hydraulics before the wheels begin to turn.

Stop bit
A bit sent at the end of every character to enable the detection of the end of the character. Then the hardware can synchronize again with the character stream.

T

TAP
Tuning parameter for guidance algorithms.

Target height
Height on the target plane that the blade will attempt to reach. This is the design height (6) ± the offset (5). When the blade reaches the target height, the height indicator arrow turns green.

V

VDOP
A measurement of the vertical PDOP.

VI
Vegetation Index. A value that is calculated (or derived) from sets of remotely-sensed data used to quantify plant health, stress, and vigor.

VRA
Variable Rate Application. The rate of fertilizer or other chemical applied, based on information supplied to a rate controller.

W

Wheelbase
The distance between the front and rear axles. On tracked vehicles, the wheelbase is exactly half the length of the track.